1. INTRODUCTION

This decommissioning analysis is designed to provide AmerenUE with sufficient information to prepare the financial planning documents for decommissioning, as required by the Nuclear Regulatory Commission (NRC or Commission). It is not a detailed assessment, but a financial analysis prepared in advance of the engineering and planning that will be required to carry out the decommissioning of the Callaway Plant.

1.1 OBJECTIVES OF STUDY

The objectives of this study are to prepare comprehensive estimates of the costs to decommission the Callaway Plant for the various scenarios outlined in Section 2, to define a sequence of events, and project volume of waste produced from the decontamination and dismantling activities.

An operating license was issued for the Callaway Plant in 1984. For the purposes of this study, the final shutdown date (license expiration) is projected to be October of 2024, based upon a 40 year operating life. This date was used as input to scheduling the decommissioning activities.

1.2 SITE DESCRIPTION

The nuclear unit is located in Callaway County, South Missouri, approximately 80 miles west of the St. Louis metropolitan area. The nearest population center is Jefferson City, 25 miles west-southwest of the plant site. The station is an 1,171 MWe (net design electrical rating) pressurized water reactor with supporting facilities.

Westinghouse Electric Company designed the Nuclear Steam Supply Steam System (NSSS). The NSSS consists of a pressurized water reactor with four independent primary coolant loops, each of which contains a reactor coolant pump and a steam generator. An electrically heated pressurizer and connecting piping complete the system. The NSSS is rated at a thermal power level of 3,579 MWt (3,565 MWt reactor core plus 14 MWt for reactor coolant pumps), with a corresponding turbine-generator gross output of 1233.6 MWe. The system is housed within a containment structure, a pre-stressed, post-tensioned concrete structure with cylindrical wall, a hemispherical dome, and a flat foundation slab. The wall and dome form a pre-stressed post-tensioned

system. The inside surface of the structure is covered with a carbon steel liner, providing a leak tight membrane.

A power conversion system converts heat produced in the reactor to electrical energy. This system converts the thermal energy of the steam into mechanical shaft power and then into electrical energy. The turbine-generator is a tandem-compound, six-flow, four element, 1800-rpm unit. The unit consists of one high pressure and three low-pressure turbine elements driving a directly coupled generator. The turbine is operated in a closed feedwater cycle that condenses the steam; the feedwater is returned to the steam generators. Heat rejected in the main condensers is removed by the circulating water system.

The circulating water system supplies cooling water to the main condenser, condensing the steam exhausted from the turbine. Cooling for the condenser circulating water system is supplied by a large natural draft cooling tower. Makeup water for the cooling tower is drawn from the Missouri River.

1.3 REGULATORY GUIDANCE

The NRC provided initial decommissioning guidance in its rule "General Requirements for Decommissioning Nuclear Facilities," issued in June 1988.[1]* This rule set forth technical and financial criteria for decommissioning licensed nuclear facilities. The regulation addressed decommissioning planning needs, timing, funding methods, and environmental review requirements. The intent of the rule was to ensure that decommissioning would be accomplished in a safe and timely manner and that adequate funds would be available for this purpose. Subsequent to the rule, the NRC issued Regulatory Guide 1.159, “Assuring the Availability of Funds for Decommissioning Nuclear Reactors,”[2] which provided guidance to the licensees of nuclear facilities on the financial methods acceptable to the NRC staff for complying with the requirements of the rule. The regulatory guide addressed the funding requirements and provided guidance on the content and form of the financial assurance mechanisms indicated in the rule amendments.

The rule defined three decommissioning alternatives as being acceptable to the NRC: DECON, SAFSTOR, and ENTOMB. It also placed limits on the time allowed to complete the decommissioning process. For SAFSTOR, the process is restricted in overall duration to 60 years unless it can be shown that a longer duration is necessary to protect public health and safety. The

* Annotated references for citations in Sections 1-6 are provided in Section 7.

guidelines for ENTOMB are similar, providing the NRC with both sufficient leverage and flexibility to ensure that these deferred options are only used in situations where it is reasonable and consistent with the definition of decommissioning. At the conclusion of a 60-year dormancy period (or longer for ENTOMB if the NRC approves such a case), the site would still require significant remediation to meet the definition of unrestricted release and license termination.

The ENTOMB alternative has not been viewed as a viable option for power reactors due to the significant time required to isolate the long-lived radionuclides for decay to permissible levels. However, with recent rulemaking permitting the controlled release of a site, the NRC has re-evaluated this alternative. The resulting feasibility study, based upon an assessment by Pacific Northwest National Laboratory, concluded that the method did have conditional merit for some, if not most reactors. However, the staff also found that additional rulemaking would be needed before this option could be treated as a generic alternative. The NRC is considering rulemaking to alter the 60-year time for completing decommissioning and to clarify the use of engineered barriers for reactor entombments. Pending completion of such rulemaking, entombment requests will be handled on a case-by-case basis.

In 1996, the NRC published revisions to the general requirements for decommissioning nuclear power plants.[3] When the decommissioning regulations were adopted in 1988, it was assumed that the majority of licensees would decommission at the end of the operating license life. Since that time, several licensees permanently and prematurely ceased operations without having submitted a decommissioning plan. In addition, these licensees requested exemptions from certain operating requirements as being unnecessary once the reactor is defueled. Each case was handled individually without clearly defined generic requirements. The NRC amended the decommissioning regulations in 1996 to clarify ambiguities and codify procedures and terminology as a means of enhancing efficiency and uniformity in the decommissioning process. The new amendments allow for greater public participation and better define the transition process from operations to decommissioning.

Under the revised regulations, licensees would submit written certification to the NRC within 30 days after the decision to cease operations. Certification would also be required once the fuel was permanently removed from the reactor vessel. Submittal of these notices would entitle the licensee to a fee reduction and eliminate the obligation to follow certain requirements needed

only during operation of the reactor. Within two years of submitting notice of permanent cessation of operations, the licensee would be required to submit a Post-Shutdown Decommissioning Activities Report (PSDAR) to the NRC. The PSDAR describes the planned decommissioning activities, the associated sequence and schedule, and an estimate of expected costs. Prior to completing decommissioning, the licensee would be required to submit an application to the NRC to terminate the license, along with a license termination plan (LTP).

1.3.1 Nuclear Waste Policy Act

Congress passed the Nuclear Waste Policy Act[4] in 1982, assigning the responsibility for disposal of spent nuclear fuel from the commercial nuclear generating plants to the Department of Energy (DOE). Two permanent disposal facilities were envisioned as well as an interim facility. To recover the cost of permanent spent fuel disposal, this legislation created a Nuclear Waste Fund through which money was to be collected from the consumers of the electricity generated by commercial nuclear power plants. The Nuclear Waste Policy Act, along with the individual disposal contracts with utilities, specified that the DOE was to begin accepting spent fuel by January 31, 1998.

After pursuing a national site selection process, the Act was amended in 1987 to designate Yucca Mountain, Nevada, as the only site to be evaluated for geologic disposal of high-level waste. Also in 1987, the DOE announced a five-year delay in the opening date for the repository, from 1998 to 2003. Two years later, in 1989, an additional 7-year delay was announced, primarily due to problems in obtaining the required permits from the state of Nevada to perform the required characterization of the site.

Generators have responded to this impasse by initiating legal action and constructing supplemental storage as a means of maintaining necessary operating margins. In a recent decision, the U.S. Court of Appeals for the Federal Circuit reaffirmed the utility position that DOE had breached its contractual obligation. However, even with the August 2000 ruling,[5] DOE's position has remained unchanged. The agency continues to maintain that its delayed performance is unavoidable because it does not have an operational repository and does not have authority to provide storage in the interim. Consequently, DOE has no plans to receive spent fuel from commercial U.S. reactors before the year 2010.

The NRC requires licensees to establish a program to manage and provide funding for the management of all irradiated fuel at the reactor until title of the fuel is transferred to the Secretary of Energy in 10 CFR 50.54 (bb).[6] This funding requirement is fulfilled through inclusion of certain high-level waste cost elements within the estimates, as described below.

For estimating purposes, AmerenUE has assumed that all spent fuel will be removed to the DOE high-level waste repository within five years after shutdown. Interim storage of the fuel, until the DOE has completed the transfer, will be in the spent fuel pool located in the Fuel Building on the Callaway site. The pool will be isolated, allowing decommissioning (or safe-storage) operations to proceed.

At shutdown, the spent fuel pool is expected to be at capacity. Over the next five years the assemblies will be packaged into multipurpose canisters for transfer to the final repository. It is assumed that the five years also provides the necessary cooling period for the final core to meet DOE's transport system requirements for decay heat.

1.3.2 Low-Level Radioactive Waste Policy Amendments Act

Congress passed the "Low-Level Radioactive Waste Disposal Act" in 1980, declaring the states as being ultimately responsible for the disposition of low-level radioactive waste generated within their own borders. The federal law encouraged the formation of regional groups or compacts to implement this objective safely, efficiently and economically, and set a target date of 1986. With little progress, the "Amendments Act" of 1985[7] extended the target, with specific milestones and stiff sanctions for non-compliance.

Missouri is a member of the seven state Midwest Compact, formed in response to the waste legislation. The development of a regional facility in Ohio was halted by the Midwest Compact Commission because of the dwindling volume of waste generated in the compact along with the rapidly rising estimated cost of developing a new disposal facility and the availability of the Barnwell site to meet compact needs. While the generators in the seven states are currently able to access the disposal facility in Barnwell, South Carolina, the situation is expected to be much different in the future. A state law passed in July 2000 limits the

annual volume of waste that can be accepted at the Barnwell site through mid-year 2008. After that date, the site can only accept waste generated within the Atlantic Compact region. Therefore, it is reasonable to assume that additional disposal capacity will be required to support reactor decommissioning, particularly for the isolation of the more highly radioactive material that is not suitable for disposal elsewhere. This analysis presumes that new disposal facilities will be available by the time the Callaway Plant ceases operation in 2024. However, for estimating purposes, the rate schedule for the Barnwell facility, as well as the Envirocare facility in Utah, were used to generate disposal costs.

1.3.3 Radiological Criteria for License Termination

In 1997, the NRC published Subpart E, "Radiological Criteria for License Termination,"[8] amending Part 20 of Title 10 of the Code of Federal Regulations (10 CFR §20). This subpart provided radiological criteria for releasing a facility for unrestricted use. The regulation provides that the site can be released for unrestricted use if radioactivity levels are such that the average member of a critical group would not receive a Total Effective Dose Equivalent (TEDE) in excess of 25 millirem per year, and provided residual radioactivity has been reduced to levels that are As Low As Reasonably Achievable (ALARA). The decommissioning estimate for Callaway assumes that the site will be remediated to a residual level consistent with the NRC-proscribed level.

It should be noted that the NRC and the Environmental Protection Agency (EPA) differ on the amount of residual radioactivity considered acceptable in site remediation. The EPA has two limits that apply to radioactive materials. An EPA limit of 15 millirem per year is derived from criteria established by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund). An additional limit of 4 millirem per year, as defined in 40 CFR Part 141.16, is applied to drinking water.

The Congress has prohibited the EPA from spending funds to enforce cleanup requirements at sites under the jurisdiction of the NRC. However, the mandate is not legally binding and the possibility exists that a site, once released from its NRC license, could be subject to EPA regulation.

2. DECOMMISSIONING ALTERNATIVES

Cost studies were developed to decommission the Callaway Plant for the approved decommissioning alternatives: DECON and SAFSTOR. The duration of dormancy selected for the SAFSTOR alternative was based upon the maximum allowable interval (60 years) between cessation of operations and termination of the site license. Although the alternatives differ with respect to technique, process, cost, and schedule, they attain the same result: the ultimate release of the site for unrestricted use.

The following sections describe the basic activities associated with each alternative. Although detailed procedures for each activity identified are not provided, and the actual sequence of work may vary, the activity descriptions provide a basis not only for estimating but also for the expected scope of work, i.e., engineering and planning at the time of decommissioning.

The conceptual approach that the NRC has described in their regulations divides decommissioning into three phases. The initial phase commences with the effective date of permanent cessation of operations and involves the transition of both plant and licensee from reactor operations, i.e., power production, to facility de-activation and closure. During the first phase, notification is to be provided to the NRC certifying the permanent cessation of operations and the removal of fuel from the reactor vessel. The licensee would then be prohibited from reactor operation.

The second phase encompasses activities during the storage period or during major decommissioning activities, or a combination of the two. The third phase pertains to the activities involved in license termination. The decommissioning estimates developed for the Callaway Plant are also divided into phases or periods; however, demarcation of the phases is based upon major milestones within the project or significant changes in the projected expenditures.

2.1 DECON

The DECON alternative, as defined by the NRC, is "the alternative in which the equipment, structures, and portions of a facility and site containing radioactive contaminants are removed or decontaminated to a level that permits the property to be released for unrestricted use shortly after cessation of operations." This study does not address the cost to remove spent fuel residing at the site; such costs are funded through a surcharge on electrical

generation. However, the study does recognize the constraints imposed by the spent fuel residing on site during the decommissioning process.

2.1.1 Period 1 – Preparations

In anticipation of the cessation of plant operations, detailed preparations are undertaken to provide a smooth transition from plant operations to site decommissioning. Through implementation of a staffing transition plan, the organization required to manage the intended decommissioning activities is assembled from available plant staff and outside resources. Preparations include the planning for permanent defueling of the reactor, revision of technical specifications applicable to the operating conditions and requirements, a characterization of the facility and major components, and the development of the PSDAR.

Engineering and Planning

The PSDAR, required within two years of the notice to cease operations, provides a description of the licensee's planned decommissioning activities, a timetable, and the associated financial requirements of the intended decommissioning program. Upon receipt of the PSDAR, the NRC will make the document available to the public for comment in a local hearing to be held in the vicinity of the reactor site. Ninety days following submittal and NRC receipt of the PSDAR, the licensee may begin to perform major decommissioning activities under a modified 10 CFR §50.59 procedure, i.e., without specific NRC approval. Major activities are defined as any activity that results in permanent removal of major radioactive components, permanently modifies the structure of the containment, or results in dismantling components (for shipment) containing Greater-than-Class C waste (GTCC), as defined by 10 CFR §61. Major components are further defined as comprising the reactor vessel and internals, large bore reactor system piping, and other large components that are radioactive. The NRC includes the following additional criteria for use of the §50.59 process in decommissioning. The proposed activity must not:

- foreclose release of the site for possible unrestricted use,
- significantly increase decommissioning costs,
- cause any significant environmental impact, or
- violate the terms of the licensee's existing license.

Existing operational technical specifications are reviewed and modified to reflect plant conditions and the safety concerns associated with permanent cessation of operations. The environmental impact associated with the planned decommissioning activities is also considered. Typically, a licensee will not be allowed to proceed if the consequences of a particular decommissioning activity are greater than bounded by previously evaluated environmental assessments or impact statements. In this instance the licensee would have to submit a license amendment for the specific activity and update the environmental report.

The decommissioning program outlined in the PSDAR will be designed to accomplish the required tasks within the ALARA guidelines (as defined in 10 CFR §20) for protection of personnel from exposure to radiation hazards. It will also address the continued protection of the health and safety of the public and the environment during the dismantling activity. Consequently, in conjunction with the development of the PSDAR, activity specifications, cost-benefit and safety analyses, work packages and procedures, must be assembled in support of the proposed decontamination and dismantling activities.

Site Preparations

Following final plant shutdown, and in preparation for actual decommissioning activities, the following activities are initiated:

- Characterization of the site and surrounding environs. This includes radiation surveys of work areas, major components (including the reactor vessel and its internals), sampling of internal piping contamination levels, and primary shield cores.

- Isolation of the spent fuel storage pool and fuel handling systems, such that decommissioning operations can commence on the balance of the plant. Decommissioning operations are scheduled around the fuel handling area to the greatest extent possible such that the overall project schedule is optimized. The fuel will be transferred to the DOE as it decays to the point that it meets the heat load criteria of the containers and, as such, it is assumed that the fuel pool will remain operational for a minimum of five years following the cessation of plant operations.

- Specification of transport and disposal requirements for activated materials and/or hazardous materials, including shielding and waste stabilization.

- Development of procedures for occupational exposure control, control and release of liquid and gaseous effluent, processing of radwaste (including dry-active waste, resins, filter media, metallic and non-metallic components generated in decommissioning), site security and emergency programs, and industrial safety.

2.1.2 Period 2 – Decommissioning Operations

Significant decommissioning activities in this phase include:

- Construction of temporary facilities and/or modification of existing facilities to support dismantling activities. This may include a centralized processing area to facilitate equipment removal and component preparations for off-site disposal.

- Reconfiguration and modification of site structures and facilities as needed to support decommissioning operations. This may include the upgrading of roads (on and off-site) to facilitate hauling and transport. Building modifications may be required to the reactor building to facilitate access of large/heavy equipment. Modifications may also be required to the refueling area of the reactor building to support the segmentation of the reactor vessel internals and component extraction.

- Design and fabrication of temporary and permanent shielding to support removal and transportation activities, construction of contamination control envelopes, and the procurement of specialty tooling.

- Procurement (lease or purchase) of shipping canisters, cask liners, and industrial packages.

- Decontamination of components and piping systems as required to control (minimize) worker exposure.

- Removal of piping and components no longer essential to support decommissioning operations.

- Removal of control rod drive housings and the head service structure from reactor vessel head. Segmentation of the vessel closure head.

- Removal and segmentation of the upper internals assemblies. Segmentation will maximize the loading of the shielded transport casks, i.e., by weight and activity. The operations are conducted under water using remotely operated tooling and contamination controls.

- Disassembly and segmentation of the remaining reactor internals, including core former and lower core support assembly. Some material is expected to exceed Class C disposal requirements. As such, the segments will be packaged in a modified fuel canister for geologic disposal.

- Segmentation of the reactor vessel. Install shielded platform for segmentation of reactor vessel. Cutting operations are performed in air using remotely operated equipment within a contamination control envelope, with the water level maintained just below the cut to minimize the working area dose rates. Segments are transferred in-air to containers that are stored under water, for example, in an isolated area of the refueling canal.

- Removal of the activated portions of the concrete biological shield and accessible contaminated concrete surfaces. If dictated by the steam generator and pressurizer removal scenarios, remove those portions of the associated cubicles necessary for access and component extraction.

- Removal of the steam generators and pressurizer for controlled disposal. Decontaminate exterior surfaces, as required, and seal-weld openings (nozzles, inspection hatches, and other penetrations). These components can serve as their own burial containers provided that all penetrations are properly sealed and the internal contaminants are stabilized. Add steel shields to those external areas of the steam generators necessary in order to meet transportation limits and regulations.

At least two years prior to the anticipated date of license termination, a LTP is required. Submitted as a supplement to the Final Safety Analysis Report (FSAR), or equivalent, the plan must include: a site characterization, description of the remaining dismantling activities, plans for site remediation, procedures for the final radiation survey, designation of the end use of the site, an updated cost estimate to complete the decommissioning, and any associated environmental concerns. The NRC will notice the receipt of the plan, make the plan available for public comment, and schedule a local hearing. LTP approval will be subject to any conditions and limitations as deemed appropriate by the Commission. The licensee may then commence with the final remediation of site facilities and services, including:

- Removal of remaining plant systems and associated components as they become nonessential to the decommissioning program or worker health and safety (e.g., waste collection and treatment systems, electrical power and ventilation systems).

- Removal of the steel liners from refueling canal, disposing of the activated and contaminated sections as radioactive waste. Removal of any activated/contaminated concrete.

- Surveys of the decontaminated areas of the containment structure.

- Removal of the contaminated equipment and material from the Auxiliary and Fuel buildings and any other contaminated facility. Use radiation and contamination control techniques until radiation surveys indicate that the structures can be released for unrestricted access and conventional demolition. This activity may necessitate the dismantling and disposition of most of the systems and components (both clean and contaminated) located within these buildings. This activity will facilitate surface decontamination and subsequent verification surveys required prior to obtaining release for demolition.

- Removal of the remaining components, equipment, and plant services in support of the area release survey(s).

- Routing of material removed in the decontamination and dismantling to a central processing area. Material certified to be free of contamination would be released for unrestricted disposition,

e.g., as scrap, recycle, or general disposal. Contaminated material will be characterized and segregated for additional off-site processing (disassembly, chemical cleaning, volume reduction, and waste treatment), and/or packaged for controlled disposal at a low-level radioactive waste disposal facility.

Incorporated into the LTP is the Final Survey Plan. This plan identifies the radiological surveys to be performed once the decontamination activities are completed and is developed using the guidance provided in NUREG/CR-1575, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)"[9]. This document incorporates the statistical approaches to survey design and data interpretation used by the EPA. It also identifies state-of-the-art, commercially available, instrumentation and procedures for conducting radiological surveys. Use of this guidance ensures that the surveys are conducted in a manner that provides a high degree of confidence that applicable NRC criteria are satisfied. Once the survey is complete, the results are provided to the NRC in a format that can be verified. The NRC then reviews and evaluates the information, performs an independent confirmation of radiological site conditions, and makes a determination on final termination of the license.

The NRC will terminate the operating license if it determines that site remediation has been performed in accordance with the LTP, and that the terminal radiation survey and associated documentation demonstrate that the facility is suitable for release.

2.1.3 Period 3 – Site Restoration

Following completion of decommissioning operations, site restoration activities may begin. Efficient removal of the contaminated materials and verification that residual radionuclide concentrations are below the NRC limits may result in substantial damage to many of the structures. Although performed in a controlled, safe manner blasting, coring, drilling, scarification (surface removal), and the other decontamination activities will substantially degrade power block structures including the Reactor, Auxiliary, Fuel and Radwaste buildings. Verifying that subsurface radionuclide concentrations meet NRC site release requirements may require removal of grade slabs and lower floors, potentially weakening footings and structural supports. This removal activity will be necessary for those facilities and plant areas where

historical records, when available, indicate the potential for radionuclides having been present in the soil, where system failures have been recorded, or where it is required to confirm that subsurface process and drain lines were not breached over the operating life of the station.

Prompt dismantling of site structures is clearly the most appropriate and cost-effective option. It is unreasonable to anticipate that these structures would be repaired and preserved after the radiological contamination is removed. The cost to dismantle site structures with a work force already mobilized on site is more efficient than if the process is deferred. Site facilities quickly degrade without maintenance, adding additional expense and creating potential hazards to the public as well as to future workers. Abandonment creates a breeding ground for vermin infestation as well as other biological hazards.

This cost study presumes that non-essential structures and site facilities will be dismantled as a continuation of the decommissioning activity. Foundations and exterior walls are removed to a nominal depth of three feet below grade. The three-foot depth allows for the placement of gravel for drainage, as well as topsoil, so that vegetation can be established for erosion control. Site areas affected by the dismantling activities are restored and the plant area graded as required to prevent ponding and inhibit the refloating of subsurface materials.

Concrete rubble produced by demolition activities is processed to remove rebar and miscellaneous embedments. The processed material is then used on-site to backfill voids. Excess materials are trucked off-site for disposal as construction debris.

2.2 SAFSTOR

The NRC defines SAFSTOR as "the alternative in which the nuclear facility is placed and maintained in a condition that allows the nuclear facility to be safely stored and subsequently decontaminated (deferred decontamination) to levels that permit release for unrestricted use." The facility is left intact (during the SAFSTOR period), with structures maintained in a sound condition. Systems not required to operate in support of the spent fuel pool or site surveillance and security are drained, de-energized, and secured. Minimal cleaning/removal of loose contamination and/or fixation and sealing

of remaining contamination is performed. Access to contaminated areas is secured to provide controlled access for inspection and maintenance.

The engineering and planning requirements are similar to those for the DECON alternative, although a shorter time period is expected for these activities due to the more limited work scope. Site preparations are also similar to those for the DECON alternative. However, with the exception of the required radiation surveys and site characterizations, the mobilization and preparation of site facilities is less extensive.

2.2.1 Period 1 - Preparations

Preparations for long-term storage include the planning for permanent defueling of the reactor, revision of technical specifications appropriate to the operating conditions and requirements, a characterization of the facility and major components, and the development of the PSDAR.

The process of placing the plant in safe-storage includes, but is not limited to, the following activities:

- Isolation of the spent fuel storage services and fuel handling systems located in the Fuel Building so that safe-storage operations may commence on the balance of the plant. This activity may be carried out by plant personnel in accordance with existing operating technical specifications. Activities are scheduled around the fuel handling systems to the greatest extent possible. The fuel will be transferred to the DOE as it decays to the point that it meets the heat load criteria of the containers and, as such, it is assumed that the fuel pool will remain operational for a minimum of five years following the cessation of plant operations.

- Draining and de-energizing of the non-contaminated systems not required to support continued site operations or maintenance.

- Disposing of contaminated filter elements and resin beds not required for processing wastes from layup activities for future operations.

- Draining of the reactor vessel. The internals will be left in place and the vessel head secured.

- Draining and de-energizing non-essential, contaminated systems. Decontaminate systems as required for future maintenance and inspection.

- Preparing lighting and alarm systems whose continued use is required. De-energizing portions of fire protection, electric power, and HVAC systems whose continued use is not required.

- Cleaning of the loose surface contamination from building access pathways.

- Performing an interim radiation survey of plant; post warning signs, as appropriate.

- Erecting physical barriers and/or securing all access to radioactive or contaminated areas, except as required for inspection and maintenance.

- Installing security and surveillance monitoring equipment and relocating security fence around secured structures, as required.

2.2.2 Period 2 - Dormancy

The second phase identified by the NRC in its rule addresses licensed activities during a storage period and is applicable to the dormancy phases of the deferred decommissioning alternative SAFSTOR. Dormancy activities include a 24-hour security force, preventive and corrective maintenance on security systems, area lighting, general building maintenance, heating and ventilation of buildings, routine radiological inspections of contaminated structures, maintenance of structural integrity, and a site environmental and radiation monitoring program. Resident maintenance personnel perform equipment maintenance, inspection activities, and routine services. This work force will maintain the structures in a safe condition, provide adequate lighting, heating, and ventilation, and perform periodic preventive maintenance on essential site services.

An environmental surveillance program is carried out during the dormancy period to ensure that releases of radioactive material to the environment are prevented and/or detected and controlled. Appropriate emergency procedures are established and initiated for potential releases that exceed prescribed limits. The environmental surveillance program constitutes an abbreviated version of the program in effect during normal plant operations.

Security during the dormancy period is conducted primarily to prevent unauthorized entry and to protect the public from the consequences of its own actions. The security fence, sensors, alarms, and other surveillance equipment provide security. Fire and radiation alarms are also monitored and maintained. While remote surveillance is an option, it does not offer the immediate response time of a physical presence.

After an optional period of storage (such that license termination is accomplished within 60 years of final shutdown), it is required that the licensee submit an application to terminate the license, along with a termination plan (described in Section 2.1.2), thereby initiating the third phase.

2.2.3 Periods 3 and 4 – Deferred Decommissioning

Prior to the commencement of decommissioning operations, preparations are undertaken to reactivate site services and prepare for decommissioning. Preparations include engineering and planning, a detailed site characterization, and the assembly of a decommissioning management organization. Final planning for activities and the writing of activity specifications and detailed procedures are also initiated at this time.

Much of the work in developing a termination plan is relevant to the development of the detailed engineering plans and procedures. The activities associated with this phase, as well as the follow-on decontamination and dismantling processes are detailed in Sections 2.1.1 and 2.1.2. The primary difference between the sequences anticipated for the DECON and SAFSTOR scenarios is the absence, in the latter, of any constraint on the availability of the fuel storage facilities located within the Fuel Building for decommissioning.

Variations in the length of the dormancy period are expected to have little effect upon the quantities of radioactive wastes generated from system and structure removal operations. Given the levels of radioactivity and spectrum of radionuclides expected from thirty to forty years of plant operation, no plant process system identified as being contaminated upon final shutdown will become releasable due to the decay period alone, i.e., there is no significant reduction in waste volume in delaying decommissioning. In fact, SAFSTOR estimates can show a slight increase in the total projected waste volume, due primarily to initial preparation activities for placing the station in safe-storage, as well as from follow-up housekeeping tasks over the caretaking period for the station.

The delay in decommissioning does yield lower working area radiation levels. As such, the estimates for the delayed scenarios incorporate

reduced ALARA controls for the SAFSTOR's lower occupational exposure potential.

Although the initial radiation levels due to ^{60}Co will decrease during the dormancy period, the internal components of the reactor vessel will still exhibit sufficiently high radiation dose rates to require remote sectioning under water due to the presence of long-lived radionuclides such as ^{94}Nb, ^{59}Ni, and ^{63}Ni. Therefore, the dismantling procedures described for the DECON alternative would still be employed during SAFSTOR. Portions of the sacrificial shield will still be radioactive due to the presence of activated trace elements with long half-lives (^{152}Eu and ^{154}Eu). Decontamination will require controlled removal and disposal. It is assumed that radioactive corrosion products on inner surfaces of piping and components will not have decayed to levels that will permit unrestricted use or allow conventional removal. These systems and components will be surveyed as they are removed, and disposed of in accordance with the existing radioactive release criteria.

2.2.4 Period 5 – Site Restoration

Following completion of decommissioning operations, site-restoration activities may begin. Dismantling of the site structures as a continuation of the decommissioning process is clearly the most appropriate and cost-effective option, as described in Section 2.1.3. The basis for the dismantling cost in the SAFSTOR scenario is consistent with that described for DECON, presuming the removal of structures and site facilities to a nominal depth of three feet below grade and the limited restoration of the site.

3. COST ESTIMATE

The cost estimates prepared for decommissioning the Callaway Plant consider the unique features of the site, including the nuclear steam supply system, power generation systems, support services, site buildings, and ancillary facilities. The basis of the estimates, including the sources of information relied upon, the estimating methodology employed, site-specific considerations, as well as other pertinent assumptions, is described in this section.

3.1 BASIS OF ESTIMATE

The current estimates were developed using the basic design information originally generated for the decommissioning analysis prepared in 1999.[10] The information was reviewed for the current estimate and updated, as deemed necessary. The site-specific considerations and assumptions used in the previous estimate were also revisited. Modifications were incorporated where new information was available or experience from ongoing decommissioning programs provided viable alternatives or improved processes.

3.2 METHODOLOGY

The methodology used to develop this cost estimate follows the basic approach originally presented in the AIF/NESP-036 study report, "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates,"[11] and the US DOE "Decommissioning Handbook."[12] These documents present a unit factor method for estimating decommissioning activity costs, which simplifies the estimating calculations. Unit factors for concrete removal ($/cubic yard), steel removal ($/ton), and cutting costs ($/inch) were developed using local labor rates. The activity-dependent costs were estimated with the item quantities (cubic yards and tons), developed from plant drawings and inventory documents. Removal rates and material costs for the conventional disposition of components and structures relied upon information available in the industry publication, "Building Construction Cost Data," published by R.S. Means.[13]

This estimate reflects lessons learned from TLG's involvement in the Shippingport Station Decommissioning Project, completed in 1989, as well as the decommissioning of the Cintichem reactor, hot cells and associated facilities, completed in 1997. In addition, the planning and engineering for

the Pathfinder, Shoreham, Rancho Seco, Trojan, Yankee Rowe, Big Rock Point, Maine Yankee, Humboldt Bay-3, Oyster Creek, Connecticut Yankee and San Onofre-1 nuclear units has provided additional insight into the process, the regulatory aspects and technical challenges of decommissioning commercial nuclear units.

The unit factor method provides a demonstrable basis for establishing reliable cost estimates. The detail provided in the unit factors, including activity duration, labor costs (by craft), and equipment and consumable costs, ensures that essential elements have not been omitted. Appendix A presents the detailed development of a typical unit factor. Appendix B provides the values contained within one set of factors developed for this analysis.

Work Difficulty Factors

TLG has historically applied work difficulty adjustment factors (WDFs) to account for the inefficiencies in working in a power plant environment. WDFs were assigned to each unique set of unit factors, commensurate with the inefficiencies associated with working in confined, hazardous environments. The ranges used for the WDFs are as follows:

- Access Factor 10% to 20%
- Respiratory Protection Factor 10% to 50%
- Radiation/ALARA Factor 10% to 37%
- Protective Clothing Factor 10% to 30%
- Work Break Factor 8.33%
- Productivity adjustable

The factors and their associated range of values were developed in conjunction with the AIF/NESP-036 study. The application of the factors is discussed in more detail in that publication.

Scheduling Program Durations

The unit factors, adjusted by the WDFs as described above, are applied against the inventory of materials to be removed in the radiologically controlled areas. The resulting man-hours, or crew-hours, are used in the development of the decommissioning program schedule, using resource loading and event sequencing considerations. The scheduling of conventional removal and dismantling activities relied upon productivity information available from the "Building Construction Cost Data" publication.

An activity duration critical path is used to determine the total decommissioning program schedule. The schedule is relied upon in calculating the carrying costs, which include program management, administration, field engineering, equipment rental, and support services such as quality control and security. This systematic approach for assembling decommissioning estimates ensures a high degree of confidence in the reliability of the resulting costs.

3.3 FINANCIAL COMPONENTS OF THE COST MODEL

TLG's proprietary decommissioning cost model, DECCER, produces a number of distinct cost elements. These direct expenditures, however, do not comprise the total cost to accomplish the project goal, i.e., license termination and site restoration.

Inherent in any cost estimate that does not rely on historical data is the inability to specify the precise source of costs imposed by factors such as tool breakage, accidents, illnesses, weather delays, and labor stoppages. In the DECCER cost model, contingency fulfills this role. Contingency is added to each line item to account for costs that are difficult or impossible to develop analytically. Such costs are historically inevitable over the duration of a job of this magnitude; therefore, this cost analysis includes funds to cover these types of expenses.

3.3.1 Contingency

The activity- and period-dependent costs are combined to develop the total decommissioning cost. A contingency is then applied on a line-item basis, using one or more of the contingency types listed in the AIF/NESP-036 study. "Contingencies" are defined in the American Association of Cost Engineers "Project and Cost Engineers' Handbook"[14] as "specific provision for unforeseeable elements of cost within the defined project scope; particularly important where previous experience relating estimates and actual costs has shown that unforeseeable events which will increase costs are likely to occur." The cost elements in this estimate are based upon ideal conditions and maximum efficiency; therefore, consistent with industry practice, a contingency factor has been applied. In the AIF/NESP-036 study, the types of unforeseeable events that are likely to occur in decommissioning are discussed and guidelines are provided for

percentage contingency in each category. It should be noted that contingency, as used in this estimate, does not account for price escalation and inflation in the cost of decommissioning over the remaining operating life of the unit.

The use and role of contingency within decommissioning estimates is not a "safety factor issue." Safety factors provide additional security and address situations that may never occur. Contingency funds are expected to be fully expended throughout the program. They also provide assurance that sufficient funding is available to accomplish the intended tasks. An estimate without contingency, or from which contingency has been removed, can disrupt the orderly progression of events and jeopardize a successful conclusion to the decommissioning process.

For example, the most technologically challenging task in decommissioning a commercial nuclear station will be the disposition of the reactor vessel and internal components, which have become highly radioactive after a lifetime of exposure to radiation produced in the core. The disposition of these highly radioactive components forms the basis for the critical path (schedule) for decommissioning operations. Cost and schedule are interdependent and any deviation in schedule has a significant impact on cost for performing a specific activity.

Disposition of the reactor vessel internals involves the underwater cutting of complex components that are highly radioactive. Costs are based upon optimum segmentation, handling, and packaging scenarios. The schedule is primarily dependent upon the turnaround time for the heavily shielded shipping casks, including preparation, loading, and decontamination of the containers for transport. The number of casks required is a function of the pieces generated in the segmentation activity, a value calculated on optimum performance of the tooling employed in cutting the various subassemblies. The risk and uncertainties associated with this task are that the expected optimization may not be achieved, resulting in delays and additional program costs. For this reason, contingency must be included to mitigate the consequences of the expected inefficiencies inherent in this complex activity, along with related concerns associated with the operation of highly specialized tooling, field conditions and water clarity.

Contingency funds are an integral part of the total cost to complete the decommissioning process. Exclusion of this component puts at risk a successful completion of the intended tasks and, potentially, subsequent related activities. For this study, TLG examined the major activity-related problems (decontamination, segmentation, equipment handling, packaging, transport, and waste disposal) that necessitate a contingency. Individual activity contingencies ranged from 0% to 75%, depending on the degree of difficulty judged to be appropriate from TLG's actual decommissioning experience. The contingency values used in this study are as follows:

Decontamination	50%
Contaminated Component Removal	25%
Contaminated Component Packaging	10%
Contaminated Component Transport	15%
Low-Level Radioactive Waste Disposal	25%
Reactor Segmentation	75%
NSSS Component Removal	25%
Reactor Waste Packaging	25%
Reactor Waste Transport	25%
Reactor Vessel Component Disposal	50%
GTCC Disposal	15%
Non-Radioactive Component Removal	15%
Heavy Equipment and Tooling	15%
Supplies	25%
Engineering	15%
Energy	15%
Characterization and Termination Surveys	30%
Construction	15%
Taxes and Fees	10%
Insurance	10%
Staffing	15%

The overall contingency, when applied to the appropriate components of the estimates on a line item basis, results in an average value of 19.1% for the DECON alternative and 17.3% for SAFSTOR.

3.3.2 Financial Risk

In addition to the routine uncertainties addressed by contingency, another cost element that is sometimes necessary to consider when bounding decommissioning costs relates to uncertainty, or risk. Examples can include changes in work scope, pricing, job performance, and other variations that could conceivably, but not necessarily, occur. Consideration is sometimes necessary to generate a level of confidence in the estimate, within a range of probabilities. TLG considers these types of costs under the broad term "financial risk." Included within the category of financial risk are:

- Transition activities and costs: ancillary expenses associated with eliminating 50% to 80% of the site labor force shortly after the cessation of plant operations, added cost for worker separation packages throughout the decommissioning program, national or company-mandated retraining, and retention incentives for key personnel.

- Delays in approval of the decommissioning plan due to intervention, public participation in local community meetings, legal challenges, and national and local hearings.

- Changes in the project work scope from the baseline estimate, involving the discovery of unexpected levels of contaminants, contamination in places not previously expected, contaminated soil previously undiscovered (either radioactive or hazardous material contamination), variations in plant inventory or configuration not indicated by the as-built drawings.

- Regulatory changes, e.g., affecting worker health and safety, site release criteria, waste transportation, and disposal.

- Policy decisions altering national commitments, e.g., in the ability to accommodate certain waste forms for disposition, or in the timetable for such.

- Pricing changes for basic inputs, such as labor, energy, materials, and burial. Some of these inputs may vary slightly, e.g. -10% to +20%; burial could vary from -50% to +200% or more.

It has been TLG's experience that the results of a risk analysis, when compared with the base case estimate for decommissioning, indicate that the chances of the base decommissioning estimate's being too high is a low probability, and the chances that the estimate is too low is a much higher probability. This is mostly due to the pricing uncertainty for low-level radioactive waste burial, and to a lesser extent due to schedule increases from changes in plant conditions and to pricing variations in the cost of labor (both craft and staff). This cost study, however, does not add any additional costs to the estimate for financial risk since there is insufficient historical data from which to project future liabilities. Consequently, the areas of uncertainty or risk are revisited periodically and addressed through repeated revisions or updates of the base estimate.

3.4 SITE-SPECIFIC CONSIDERATIONS

There are a number of site-specific considerations that affect the method for dismantling and removal of equipment from the site and the degree of restoration required. The cost impact of the considerations identified below is included in this cost study.

3.4.1 Spent Fuel Management

The cost to dispose of the spent fuel generated from plant operations is not reflected within the estimates to decommission the Callaway Plant. Ultimate disposition of the spent fuel is within the province of the DOE's Waste Management System, as defined by the Nuclear Waste Policy Act. As such, the disposal cost is financed by a 1 mill/kWhr surcharge paid into the DOE's waste fund during operations. However, the NRC requires licensees to establish a program to manage and provide funding for the management of all irradiated fuel at the reactor until title of the fuel is transferred to the Secretary of Energy. This funding requirement is fulfilled through inclusion of certain high-level waste cost elements within the estimates, as described below.

For estimating purposes, AmerenUE has assumed that all spent fuel will be removed to the DOE high-level waste repository within five years after shutdown. Interim storage of the fuel, until the DOE has completed the transfer, will be in the spent fuel pool located in the Fuel Building on the Callaway site. This will allow AmerenUE to proceed with decommissioning (or safe-storage) operations in the shortest time

possible. A delay in the startup of the repository, or a decrease in the spent fuel acceptance rate, will correspondingly prolong the transfer process and result in the fuel remaining at the Callaway site longer.

At shutdown, the spent fuel pool is expected to be at capacity. Over the next five years the assemblies will be packaged into multipurpose canisters for transfer to the final repository. It is assumed that the five years also provides the necessary cooling period for the final core to meet DOE's transport system requirements for decay heat. Once the pool is emptied, the spent fuel storage and handling facilities are available for decommissioning. Operation and maintenance costs for the spent fuel pool are included within the estimate as well as the costs for transferal of spent fuel to the DOE.

3.4.2 Reactor Vessel and Internal Components

The NSSS (reactor vessel and reactor recirculation system components) will be decontaminated using chemical agents prior to the start of cutting operations. A decontamination factor (average reduction) of 10 is presumed.

The reactor pressure vessel and reactor internal components are segmented for disposal in shielded, reusable transportation casks. Segmentation is performed in the refueling canal, where a turntable and remote cutter are installed. The vessel is segmented in place, using a mast-mounted cutter supported off the lower head and directed from a shielded work platform installed overhead in the reactor cavity. Transportation cask specifications and transportation regulations will dictate segmentation and packaging methodology.

The dismantling of the reactor internals will generate radioactive waste considered unsuitable for shallow land disposal, i.e., GTCC. Although the material is not classified as high-level waste, DOE has indicated it will accept title to this waste for disposal at the future high-level waste repository.[15] However, the DOE has not been forthcoming with an acceptance criteria or disposition schedule for this material, and numerous questions remain as to the ultimate disposal cost and waste form requirements. As such, for purposes of this study, the GTCC has been packaged and disposed of as high-level waste, at a cost equivalent to that envisioned for the spent fuel. It is not anticipated that DOE would accept this waste prior to completing the transfer of spent fuel.

Therefore, until such time as the DOE is ready to accept GTCC waste, it is reasonable to assume that this material would remain in storage at the Callaway site.

Intact disposal of the reactor vessel and internal components can provide savings in cost and worker exposure by eliminating the complex segmentation requirements, isolation of the GTCC material, and transport/storage of the resulting waste packages. Portland General Electric (PGE) was able to dispose of the Trojan reactor as an intact package. However, the location of the Trojan Nuclear Plant on the Columbia River simplified the transportation analysis since:

- the reactor package could be secured to the transport vehicle for the entire journey, i.e., the package was not lifted during transport,
- there were no man-made or natural terrain features between the plant site and the disposal location that could produce a large drop, and
- transport speeds were very low, limited by the overland transport vehicle and the river barge.

As a member of the Northwest Compact, PGE had a site available for disposal of the package, the US Ecology facility in Washington State. The characteristics of this arid site proved favorable in demonstrating compliance with land disposal regulations.

It is not known whether this option will be available when the Callaway Plant ceases operation. Future viability of this option will depend upon the ultimate location of the disposal site, as well as the disposal site licensee's ability to accept highly radioactive packages and effectively isolate them from the environment. Consequently, the study assumes the reactor vessel will have to be segmented, as a bounding condition.

3.4.3 Primary System Components

The following discussion deals with the removal and disposition of the steam generators, but the techniques involved are also applicable to other large components, such as heat exchangers, component coolers and the pressurizer. The steam generators' size and weight, as well as their location within the Reactor Building, will ultimately determine the removal strategy.

A potential method for removal (and the one used as the basis in this estimate) is the extraction of the generators through the existing equipment hatch. Sections of the steam generator cubicle walls, adjoining floor slabs, and floor grating may need to be removed to allow for the generators to be maneuvered to the hatch.

Grating within the work area will be decontaminated and removed. Next, a trolley crane will be set up for removal of the generators. By setting the trolley crane first, it can be used to move portions of the steam generator cubicle walls and floor slabs from the Reactor Building to a location where they can be decontaminated and transported to the material handling area.

The generators will be rigged for removal, disconnected from the surrounding piping and supports, and maneuvered into the open area where they will be lowered onto a dolly. Once each steam generator has been placed in the horizontal position, nozzles and other openings will be welded closed. The lower shell will have a carbon steel membrane welded to its outside surface for shielding, if required, during transport. The interior volume will be filled with low-density cellular concrete for stabilization of the internal contamination and to satisfy burial ground packaging requirements. When this stage has been completed, each generator moved out of containment and lowered onto a multi-wheeled transporter. The generators will be staged at an on-site storage area to await transport to the disposal facility. The pressurizer will be removed using the same technique. Each component will then be loaded onto a railcar for transport to the disposal facility.

Reactor coolant piping is cut from the reactor vessel once the water level in the vessel (used for personnel shielding during dismantling and cutting operations in and around the vessel) is dropped below the nozzle zone. The piping is boxed and transported by shielded van. The reactor coolant pumps and motors are lifted out intact, packaged, and transported for disposal.

3.4.4 Main Turbine and Condenser

The main turbine will be dismantled using conventional maintenance procedures. The turbine rotors and shafts will be removed to a laydown area. The lower turbine casings will be removed from their anchors by controlled demolition. The main condensers will also be disassembled

and moved to a laydown area. Material is then prepared for transportation to an off-site facility for conventional disposal.

3.4.5 Transportation Methods

Contaminated piping, components, and structural material other than the highly activated reactor vessel and internal components will qualify as LSA-I, II or III or Surface Contaminated Object, SCO-I or II, as described in Title 49 of the Code of Federal Regulations.[16] The contaminated material will be packaged in Industrial Packages (IP I, II, or III) for transport unless demonstrated to qualify as their own shipping containers. The reactor vessel and internal components are expected to be transported in accordance with §71, as Type B. It is conceivable that the reactor, due to its limited specific activity, could qualify as LSA II or III. However, the high radiation levels on the outer surface would require that additional shielding be incorporated within the packaging so as to attenuate the dose to levels acceptable for transport.

Transport of the highly activated metal, produced in the segmentation of the reactor vessel and internal components, will be by shielded truck cask. Cask shipments may exceed 95,000 pounds, including vessel segment(s), supplementary shielding, cask tie-downs, and tractor-trailer. The maximum level of activity per shipment assumed permissible was based upon the license limits of the available shielded transport casks. The segmentation scheme for the vessel and internal segments is designed to meet these limits.

The transport of large intact components, e.g., large heat exchangers and other oversized components, will be by a combination of truck, rail, and/or multi-wheeled transporter.

The low-level radioactive waste requiring controlled disposal is sent to one of two currently available burial facilities. Transportation costs are based upon the mileage to either the Envirocare facility in Clive, Utah, or the Barnwell facility in South Carolina. Memphis, Tennessee, is used as the destination for off site processing. Transportation costs are estimated using published tariffs from Tri-State Motor Transit.[17]

3.4.6 Low-Level Radioactive Waste Disposal

To the greatest extent practical, metallic material generated in the decontamination and dismantling processes is treated to reduce the total volume requiring controlled disposal. The treated material, meeting the regulatory and/or site release criterion, is released as scrap, requiring no further cost consideration. Conditioning and recovery of the waste stream is performed off site at a licensed processing center.

Material requiring controlled disposal is packaged and transported to one of two currently available burial facilities. Very low-level radioactive material, e.g., dry-active waste and contaminated concrete, is sent to Envirocare. More highly contaminated and activated material is sent to Barnwell. Disposal fees are based upon current charges for operating waste with surcharges added for the highly activated components, e.g., generated in the segmentation of the reactor vessel.

3.4.7 Site Conditions Following Decommissioning

The NRC will terminate (or amend) the site license if it determines that site remediation has been performed in accordance with the license termination plan, and that the terminal radiation survey and associated documentation demonstrate that the facility is suitable for release. The NRC's involvement in the decommissioning process will end at this point. Building codes and environmental regulations will dictate the next step in the decommissioning process, as well as AmerenUE's own future plans for the site.

Structures are removed to a nominal depth of three feet below grade. Concrete rubble generated from demolition activities is processed and made available as clean fill. Non-contaminated underground piping (except the service water and circulating water piping) will be abandoned without special considerations. Accessible circulating and service water piping will be removed/collapsed and backfilled to eliminate the potential for collapse after the site is released for unrestricted access. Site utilities and service piping are abandoned in place. Electrical manholes are backfilled with suitable earthen material and abandoned. Asphalt surfaces in the immediate vicinity of site buildings are broken up and the material used for backfill on site, if needed. The existing electrical switchyard and access roads will remain in support of the electrical transmission and distribution system. Site

restoration does not include the remediation of the water treatment plant's settling basins, if required.

The estimate does not assume the remediation of any significant volume of contaminated soil. This assumption may be affected by continued plant operations and/or future regulatory actions, such as the development of site-specific release criteria.

3.5 ASSUMPTIONS

The following are the major assumptions made in the development of the estimate for decommissioning the site.

3.5.1 Estimating Basis

The study follows the principles of ALARA through the use of work duration adjustment factors. These factors address the impact of activities such as radiological protection instruction, mock-up training, and the use of respiratory protection and protective clothing. The factors lengthen a task's duration, increasing costs and lengthening the overall schedule. ALARA planning is considered in the costs for engineering and planning, and in the development of activity specifications and detailed procedures. Changes to worker exposure limits may impact the decommissioning cost and project schedule.

3.5.2 Labor Costs

The craft labor required to decontaminate and dismantle the nuclear unit will be acquired through standard site contracting practices. The current cost of labor at the site is used as an estimating basis. Costs for site administration, operations, construction, and maintenance personnel are based upon average salary information provided by AmerenUE.

AmerenUE will hire a Decommissioning Operations Contractor (DOC) to manage the decommissioning. AmerenUE will provide site security, radiological health and safety, quality assurance and overall site administration during the decommissioning and demolition phases. Contract personnel will provide engineering services, e.g., for preparing the activity specifications, work procedures, activation, and structural analyses, with AmerenUE oversight.

3.5.3 Design Conditions

Any fuel cladding failure that occurred during the lifetime of the plant is assumed to have released fission products at sufficiently low levels that the buildup of quantities of long-lived isotopes (e.g., cesium-137, strontium-90, or transuranics) has been prevented from reaching levels exceeding those that permit the major NSSS components to be shipped under current transportation regulations and disposal requirements.

The curie contents of the vessel and internals at final shutdown are derived from those listed in NUREG/CR-3474.[18] Actual estimates are derived from the curie/gram values in NUREG/CR-3474 and adjusted

for the different mass of Callaway components, projected operating life, as well as for different periods of decay. Additional short-lived isotopes were derived from NUREG/CR-0130[19] and NUREG/CR-0672[20] and benchmarked to the long-lived values from NUREG/CR-3474.

The control elements are disposed of along with the spent fuel, i.e., there is no additional cost provided for their disposal.

Activation of the Reactor building structure is confined to the biological shield. More extensive activation (at very low levels) of the interior structures within containment has been detected at several reactors and the owners have elected to dispose of the affected material at a controlled facility rather than reuse the material as fill on site or send it to a landfill. The ultimate disposition of the material removed from the Reactor Building will depend upon the site release criteria selected, as well as the designated end use for the site.

3.5.4 General

Transition Activities

Existing warehouses will be cleared of non-essential material and remain for use by AmerenUE and its subcontractors. The warehouses may be dismantled as they become surplus to the decommissioning program. The plant's operating staff will perform the following activities at no additional cost or credit to the project during the transition period:

- Drain and collect fuel oils, lubricating oils, and transformer oils for recycle and/or sale.
- Drain and collect acids, caustics, and other chemical stores for recycle and/or sale.
- Process operating waste inventories, i.e., this estimate does not address the disposition of any legacy wastes. The disposal of operating wastes during this initial period is not considered a decommissioning expense.

Scrap and Salvage

The existing plant equipment is considered obsolete and suitable for scrap as deadweight quantities only. AmerenUE will make economically reasonable efforts to salvage equipment following final plant shutdown.

However, dismantling techniques assumed by TLG for equipment in this estimate are not consistent with removal techniques required for salvage (resale) of equipment. Experience has indicated that some buyers wanted equipment stripped down to very specific requirements before they would consider purchase. This required expensive rework after the equipment had been removed from its installed location. Since placing a salvage value on this machinery and equipment would be speculative, and the value would be small in comparison to the overall decommissioning expenses, this estimate does not attempt to quantify the value that AmerenUE may realize based upon those efforts.

It is assumed, for purposes of this estimate, that any value received from the sale of scrap generated in the dismantling process would be more than offset by the on-site processing costs. The dismantling techniques assumed in the decommissioning estimate do not include the additional cost for size reduction and preparation to meet "furnace ready" conditions. For example, the recovery of copper from electrical cabling from a facility currently being decommissioned has required the removal and disposition of the PCB-contaminated insulation, an added expense. With a volatile market, the potential profit margin in scrap recovery is highly speculative, regardless of the ability to free release this material. This assumption is an implicit recognition of scrap value in the disposal of clean metallic waste at no additional cost to the project.

Furniture, tools, mobile equipment such as forklifts, trucks, bulldozers, and other such items of personal property owned by AmerenUE, will be removed at no cost or credit to the decommissioning project. Disposition may include relocation to other facilities. Spare parts will also be made available for alternative use.

Energy

For estimating purposes, the plant is assumed to be de-energized, with the exception of those facilities associated with spent fuel storage. Replacement power costs are used for the cost of energy consumption during decommissioning for tooling, lighting, ventilation, and essential services.

Insurance

Costs for continuing coverage (nuclear liability and property insurance) following cessation of plant operations and during decommissioning are included and based upon current operating premiums. Reductions in premiums, throughout the decommissioning process, are based upon the guidance and the limits for coverage defined in the NRC's proposed rulemaking "Financial Protection Requirements for Permanently Shutdown Nuclear Power Reactors." The NRC's financial protection requirements are based on various Reactor (and Spent Fuel) configurations.

Taxes

Property tax payments are included for the land only and will continue through the decommissioning project.

Site Modifications

The perimeter fence and in-plant security barriers will be moved, as appropriate, to conform to the Site Security Plan in force during the various stages of the project.

3.6 COST ESTIMATE SUMMARY

The costs projected for the decommissioning of the Callaway Plant are provided in Table 3.1 for the DECON alternative, and Table 3.2 for the SAFSTOR alternative. Decommissioning costs are reported in the year of projected expenditure; however, the values are provided in thousands of 2002 dollars. Costs are not inflated, escalated, or discounted over the period of expenditure.

The annual expenditures are based upon the detailed activity costs reported in Appendices C and D, along with the schedule discussed in Section 4.

TABLE 3.1
SCHEDULE OF ANNUAL EXPENDITURES BY PERIOD
DECON ALTERNATIVE
(thousands, 2002 dollars)

Year	Preparations	Decommissioning	Restoration	Totals
2024	9,627	0	0	9,627
2025	56,737	0	0	56,737
2026	28,358	79,796	0	108,154
2027	0	103,226	0	103,226
2028	0	57,321	0	57,321
2029	0	57,164	0	57,164
2030	0	49,358	0	49,358
2031	0	22,507	9,131	31,638
2032	0	0	34,101	34,101
2033	0	0	8,013	8,013
	94,722	369,372	51,245	515,339

Note: Columns may not add due to rounding

TABLE 3.2
SCHEDULE OF ANNUAL EXPENDITURES BY PERIOD
SAFSTOR ALTERNATIVE
(thousands, 2002 dollars)

Year	SAFSTOR Preparations	Dormancy	Decommissioning Preparations	Decommissioning	Site Restoration	Totals
2024	7,379	0	0	0	0	7,379
2025	41,733	0	0	0	0	41,733
2026	24,272	8,778	0	0	0	33,050
2027	0	12,515	0	0	0	12,515
2028	0	12,550	0	0	0	12,550
2029	0	12,515	0	0	0	12,515
2030	0	5,883	0	0	0	5,883
2031-2079	0	151,815	0	0	0	151,815
2080	0	543	32,754	0	0	33,297
2081	0	0	25,219	38,969	0	64,187
2082	0	0	0	106,976	0	106,976
2083	0	0	0	71,527	0	71,527
2084	0	0	0	24,873	7,005	31,878
2085	0	0	0	0	33,643	33,643
2086	0	0	0	0	9,770	9,770
	73,383	204,599	57,973	242,345	50,419	628,719

Note: Columns may not add due to rounding

4. SCHEDULE ESTIMATE

The schedules for the decommissioning scenarios considered in this study follow the sequence presented in the AIF/NESP-036 study, with minor changes to reflect recent experience and site-specific constraints. In addition, the scheduling has been revised to reflect the required cooling period for the spent fuel.

A schedule or sequence of activities is presented in Figure 4.1. The schedule reflects the prompt decommissioning alternative and the start date consistent with a scheduled shutdown in 2024. The sequence assumes that fuel is removed from the spent fuel pool within the first five years. The key activities listed in the schedule do not reflect a one-to-one correspondence with those activities in the Appendix C cost table, but reflect dividing some activities for clarity and combining others for convenience. The schedule was prepared using the "Microsoft Project 2000" computer software.[21]

4.1 SCHEDULE ESTIMATE ASSUMPTIONS

The schedule was generated using a precedence network and associated software. Activity durations are based upon the actual man-hour estimates calculated for each area. The schedule was assembled by sequencing the work areas, considering work crew availability and material access/egress. The following assumptions were made in the development of the decommissioning schedule:

- The Fuel Building will continue to serve as the spent fuel storage/transfer facility until such time that all spent fuel has been removed from site. The Fuel Building is expected to operate for approximately five years after the cessation of operations.

- All work (except vessel and internals removal) is performed during an 8-hour workday, 5 days per week, with no overtime. There are eleven paid holidays per year.

- Reactor and internals removal activities are performed by using separate crews for different activities working on different shifts, with a corresponding backshift charge for the second shift.

- Multiple crews work parallel activities to the maximum extent possible, consistent with optimum efficiency, adequate access for cutting, removal

and laydown space, and with the stringent safety measures necessary during demolition of heavy components and structures.

- For plant systems removal, the systems with the longest removal durations in areas on the critical path are considered to determine the duration of the activity.

4.2 PROJECT SCHEDULE

The period-dependent costs presented in Appendix C are based upon the durations developed in the schedule for decommissioning the Callaway Plant. Durations are established between several milestones in each project period; these durations are used to establish a critical path for the entire project. In turn, the critical path duration for each period is used as the basis for determining the period-dependent costs.

Project timelines for the DECON and SAFSTOR alternatives are shown in this section as Figure 4.2. Milestone dates are based on a 40-year plant operating life from the issuance of the operating license, a five-year wet storage period for the last core discharge, and a maximum deferral of sixty years for license termination (SAFSTOR) and final site release.

FIGURE 4.1

DECON ACTIVITY SCHEDULE

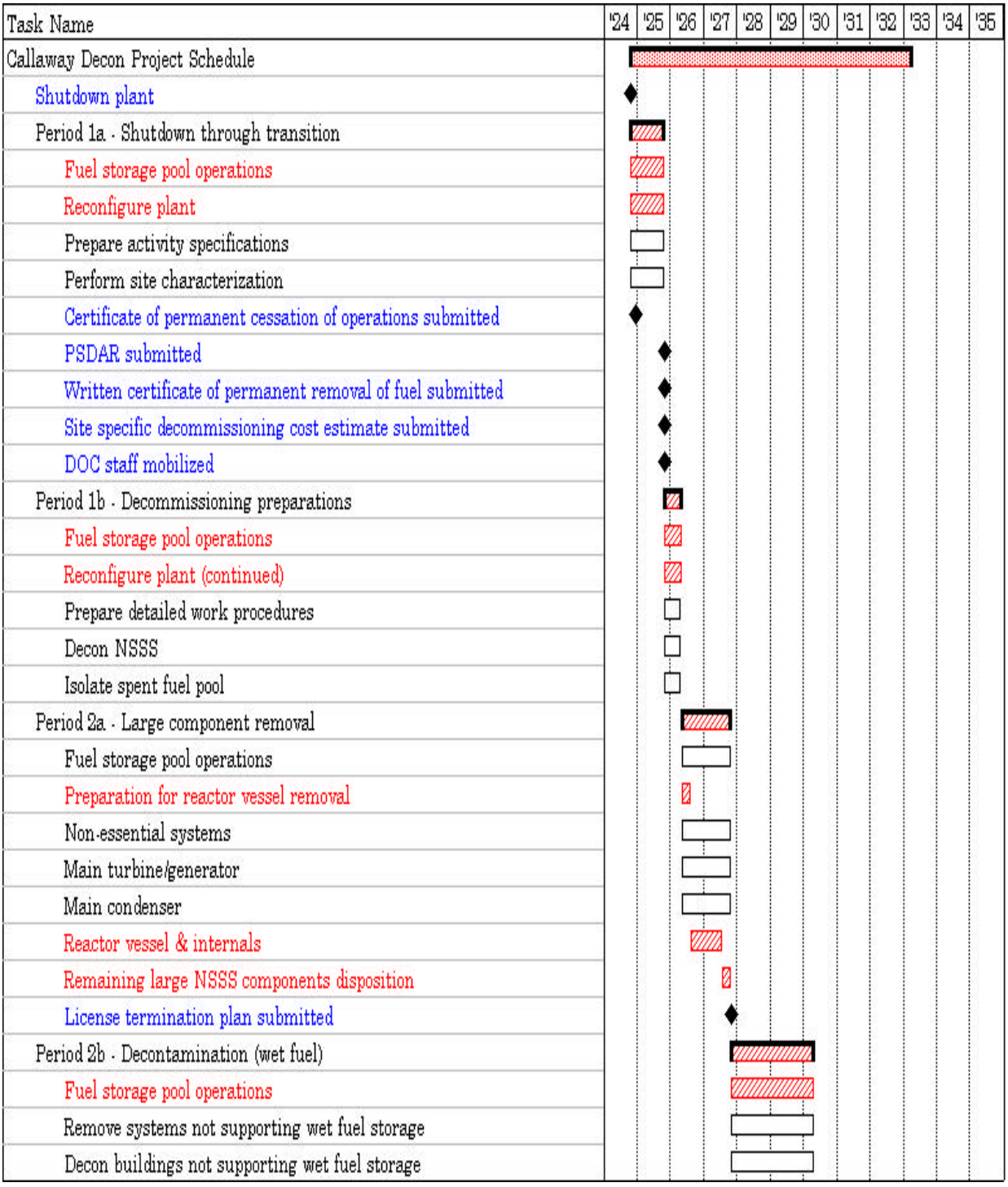


FIGURE 4.1 (Continued)

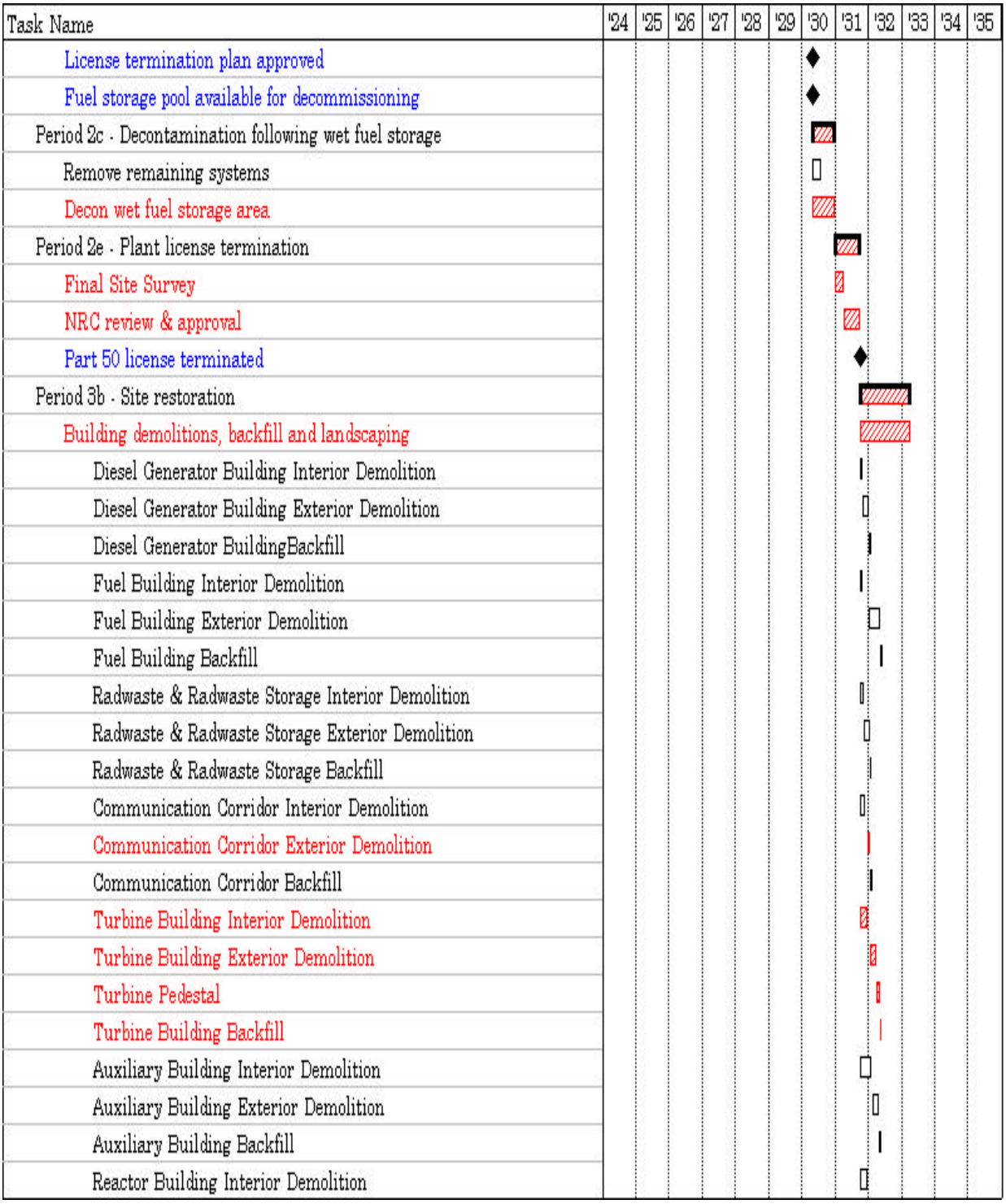


FIGURE 4.1 (Continued)

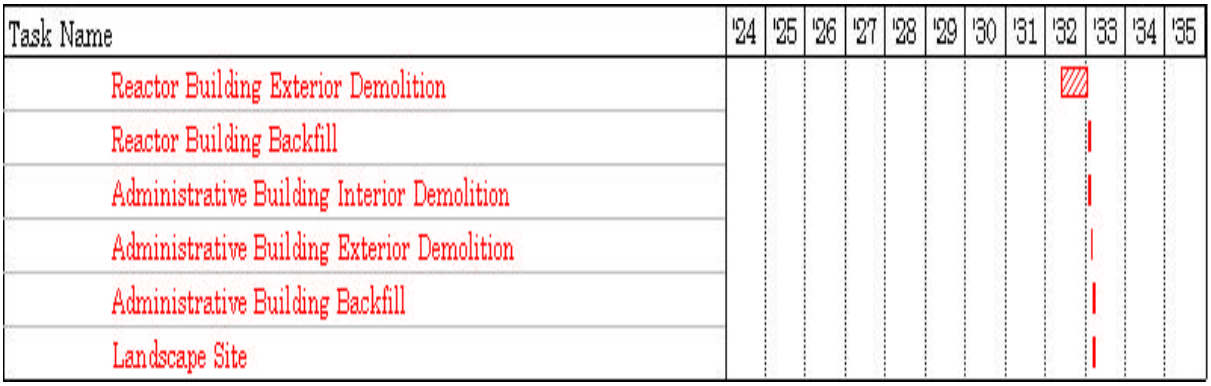
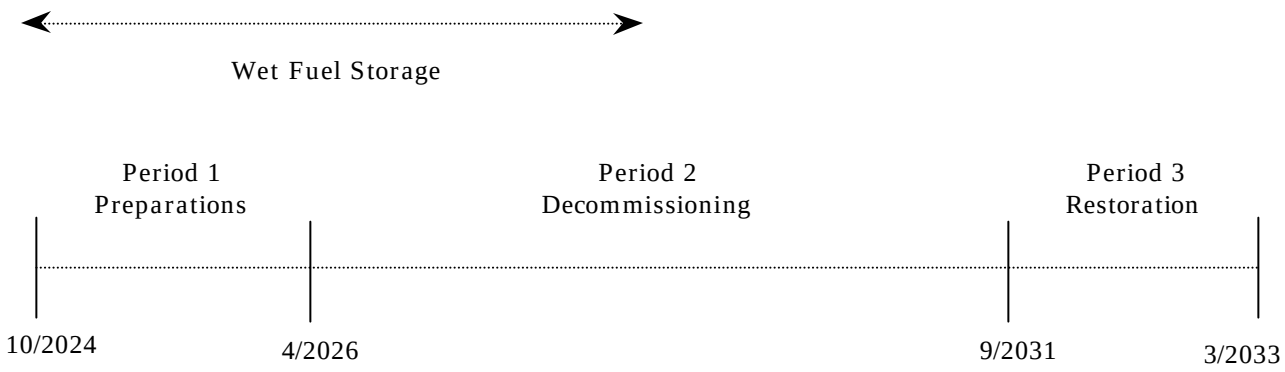


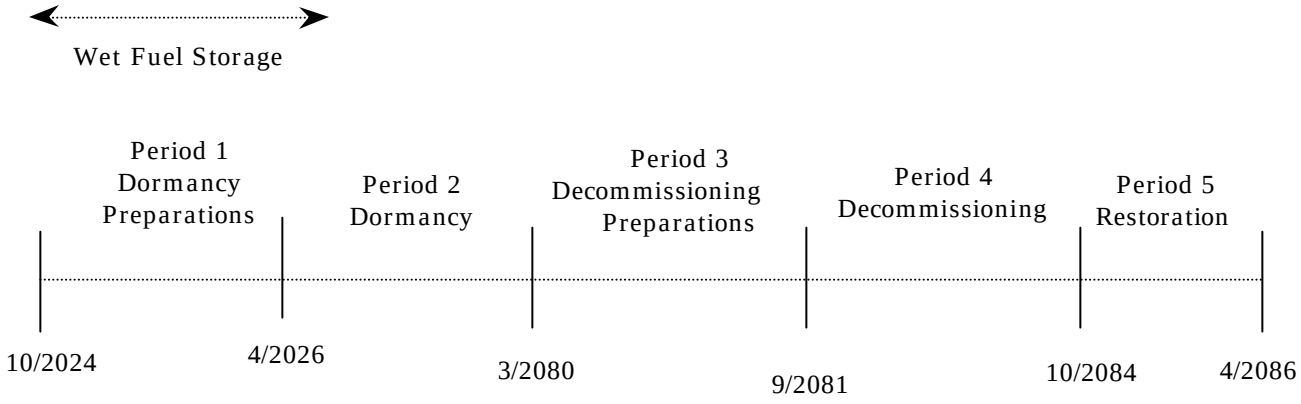
FIGURE 4.2

DECOMMISSIONING TIMELINES
(not to scale)

DECON Alternative



SAFSTOR Alternative



5. RADIOACTIVE WASTES

The objectives of the decommissioning process are the removal of all radioactive material from the site that would restrict its future use and the termination of the NRC license(s). This currently requires the remediation of all radioactive material at the site in excess of applicable legal limits. Under the Atomic Energy Act,[22] the NRC is responsible for protecting the public from sources of ionizing radiation. Title 10 of the Code of Federal Regulations delineates the production, utilization, and disposal of radioactive materials and processes. In particular, 10 CFR §71 defines radioactive material and 10 CFR §61 specifies its disposition.

Most of the materials being transported for controlled burial are categorized as Low Specific Activity (LSA) or Surface Contaminated Object (SCO) materials containing Type A quantities, as defined in 49 CFR §173-178. Shipping containers are required to be Industrial Packages (IP-1, IP-2 or IP-3). For this study, commercially available steel containers are presumed to be used for the disposal of piping, small components, and concrete. Larger components can serve as their own containers, with proper closure of all openings, access ways, and penetrations.

The volumes of radioactive waste generated during the various decommissioning activities at the site are shown on a line-item basis in Appendices C and D and summarized in Tables 5.1 and 5.2. The quantified waste volume summaries shown in these tables are consistent with §61 classifications. The volumes are calculated based on the exterior dimensions for containerized material. The volumes are calculated on the displaced volume of components serving as their own waste containers.

The reactor vessel and internals are categorized as large quantity shipments and, accordingly, will be shipped in reusable, shielded truck casks with disposable liners. In calculating disposal costs, the burial fees are applied against the liner volume, as well as the special handling requirements of the payload. Packaging efficiencies are lower for the highly activated materials (greater than Type A quantity waste), where high concentrations of gamma-emitting radionuclides limit the capacity of the shipping canisters.

No process system containing/handling radioactive substances at shutdown is presumed to meet material release criteria by decay alone, i.e., systems radioactive at shutdown will still be radioactive over the time period during which the decommissioning is accomplished, due to the presence of long-lived radionuclides.

While the dose rates decrease with time, radionuclides such as ^{137}Cs will still control the disposition requirements.

The waste material generated in the decontamination and dismantling of the Callaway Plant is primarily generated during Period 2 of the DECON alternative and Period 4 for SAFSTOR. Material that is considered potentially contaminated when removed from the radiologically controlled area is sent to processing facilities in Tennessee for conditioning and disposal at a unit cost of $2.15 per pound. Heavily contaminated components and activated materials are routed for controlled disposal. The disposal volumes reported in the tables reflect the savings resulting from reprocessing and recycling.

For purposes of constructing the estimate, the rate schedule for the Barnwell facility was used as a proxy for the higher activity waste. This schedule was used to estimate the disposal fees for the majority of plant components, as well as a portion of the activated concrete, that is not suitable for processing or recovery. An average disposal rate of $429 per cubic foot was used, with additional surcharges for activity, dose rate and/or handling added, as appropriate for the particular package.

The remaining volume of contaminated metallic and concrete debris is disposed of at the Envirocare facility. This includes lower activity material such as miscellaneous steel, metal siding, scaffolding and structural steel. A rate of $268 per cubic foot was used for containerized waste, a rate of $69.20 per cubic foot was used for disposal of DAW, and a unit rate of approximately $17 per cubic foot for bulk material, e.g., concrete.

TABLE 5.1

DECOMMISSIONING WASTE SUMMARY
DECON ALTERNATIVE

	Waste Class[1]	Volume (cubic feet)	Weight (pounds)
Low-Level Radioactive Waste			
Barnwell, South Carolina (contaminated/activated metallic waste and concrete)			
	A	59,802	6,314,306
	B	12,733	1,913,987
	C	861	105,570
Envirocare, Utah (miscellaneous steel, contaminated/activated concrete)			
Containerized/DAW	A	20,910	1,163,110
Bulk	A	10,358	1,035,792
Geologic Repository (Greater-than Class C)			
	>C	652	140,073
Total [2]		105,317	10,672,838
Processed Waste (Off-Site)		176,202	
Scrap Metal			152,236,000

[1] Waste is classified according to the requirements as delineated in Title 10 CFR, Part 61.55
[2] Columns may not add due to rounding.

TABLE 5.2

DECOMMISSIONING WASTE SUMMARY
SAFSTOR ALTERNATIVE

	Waste Class[1]	**Volume** (cubic feet)	**Weight** (pounds)
Low-Level Radioactive Waste			
Barnwell, South Carolina (contaminated/activated metallic waste and concrete)			
	A	44,311	4,877,111
	B	7,595	956,892
	C	856	101,175
Envirocare, Utah (miscellaneous steel, contaminated/activated concrete)			
Containerized/DAW	A	45,153	1,984,084
Bulk	A	6,577	657,678
Geologic Repository (Greater-than Class C)			
	>C	652	140,073
Total [2]		105,143	8,717,013
Processed Waste (Off-Site)		199,186	
Scrap Metal			152,236,000

[1] Waste is classified according to the requirements as delineated in Title 10 CFR, Part 61.55
[2] Columns may not add due to rounding.

6. RESULTS

Costs were developed to decommission the Callaway Plant following a shutdown in the year 2024. The analyses relied upon the site-specific, technical information developed for a previous analysis prepared in 1999, updated to reflect current plant conditions and operating assumptions. While not an engineering study, the estimates do provide AmerenUE with sufficient information to assess its financial obligations as they pertain to the eventual decommissioning of the nuclear station.

The estimates described in this report are based on numerous fundamental assumptions, including regulatory requirements, project contingencies, low-level radioactive waste disposal practices, high-level radioactive waste management options, and site restoration requirements. The decommissioning scenarios assume continued operation of the plant's spent fuel pool for approximately five years following the cessation of operations. During this period, the Fuel Building's storage pool will be used to safeguard the spent fuel until such time that the DOE can complete the transfer of the assemblies to its repository. The scenarios also include the costs for the dismantling of non-essential structures and limited restoration of the site.

The cost projected to promptly decommission the station, under the DECON alternative described in this document, is $515.3 million in year 2002 dollars. Approximately 88.2% of this cost is associated with the physical decontamination and dismantling of the nuclear unit so that the license can be terminated. The remainder of the expense is for the demolition of the remaining structures and limited restoration of the site. The cost to place the station in SAFSTOR, deferring decommissioning for approximately 60 years, is estimated at $628.7 million in year 2002 dollars. Approximately 90.8% of this cost is associated with the physical decontamination and dismantling of the nuclear unit so that the license can be terminated.

The primary cost contributors, identified in Tables 6.1 and 6.2, are either labor-related or associated with the management and disposition of the radioactive waste. Program management is the largest single contributor to the overall cost. The magnitude of the expense is a function of both the size of the organization required to manage the decommissioning, as well as the duration of the program. It is assumed, for purposes of this analysis, that AmerenUE will oversee the decommissioning program, using a Decommissioning Operations Contractor to manage the decommissioning labor force and the associated subcontractors. The size and composition of the management organization varies with the decommissioning phase and associated site activities.

However, once the operating license has been terminated, the staff is substantially reduced for the conventional demolition and restoration of the site.

The cost for waste disposal includes only those costs associated with the controlled disposition of the low-level radioactive waste generated from decontamination and dismantling activities, including plant equipment and components, structural material, filters, resins and dry-active waste. As described in Section 5, disposal of the lower level material, including concrete and structural steel, is at the Envirocare facility. The more highly radioactive material is sent to the Barnwell facility, with the exception of selected reactor vessel components. Highly activated components, requiring additional isolation from the environment, are packaged for geologic disposal. The cost of geologic disposal is based upon a cost equivalent for spent fuel.

A significant portion of the metallic waste is designated for additional processing and treatment at an off-site facility. Processing reduces the volume of material requiring controlled disposal through such techniques and processes as survey and sorting, decontamination and volume reduction. The material that cannot be unconditionally released is packaged for controlled disposal at one of the currently operating facilities. The costs identified in the summary tables for processing are all-inclusive, incorporating the ultimate disposition of the material.

Removal costs reflect the labor-intensive nature of the decommissioning process, as well as the management controls required to ensure a safe and successful program. Decontamination and packaging costs also have a large labor component that is based upon prevailing union wages. Non-radiological demolition is a natural extension of the decommissioning process. The methods employed in decontamination and dismantling are generally destructive and indiscriminate in inflicting collateral damage. With a work force mobilized to support decommissioning operations, non-radiological demolition can be an integrated activity and a logical expansion of the work being performed in the process of terminating the operating license. Prompt demolition reduces future liabilities and can be more cost effective than deferral, due to the deterioration of the facilities (and therefore the working conditions) with time.

The reported cost for transport includes the tariffs and surcharges associated with moving large components and/or overweight shielded casks overland, as well as the general expense, e.g., labor and fuel, of transporting material to the destinations identified in this report. For purposes of this estimate, material is primarily moved overland by truck.

Decontamination is used to reduce the plant's radiation fields and minimize worker exposure. Slightly contaminated material or material located within a contaminated area is sent to an off-site processing center, i.e., this estimate does not assume that contaminated plant components and equipment can be decontaminated for uncontrolled release in-situ. Centralized processing centers have proven to be a more economical means of handling the large volumes of material produced in the dismantling of a nuclear unit.

License termination survey costs are associated with the labor intensive and complex activity of verifying that contamination has been removed from the site to the levels specified by the regulating agency. This process involves a systematic survey of all remaining plant surface areas and surrounding environs, sampling, isotopic analysis and documentation of the findings. The status of any plant components and materials not removed in the decommissioning process will also need to be confirmed and will add to the expense of surveying the facilities alone.

The remaining costs include allocations for heavy equipment and temporary services, as well as for other expenses such as regulatory fees, and the premiums for nuclear insurance. While site operating costs are greatly reduced following the final cessation of plant operations, certain administrative functions do need to be maintained either at a basic functional or regulatory level.

TABLE 6.1

SUMMARY OF DECOMMISSIONING COST ELEMENTS
DECON
(thousands of 2002 dollars)

Work Category	Cost	Percent of Total
Decontamination	12,664	2.5
Removal	96,114	18.7
Packaging	11,155	2.2
Transportation	4,477	0.9
Waste Disposal	86,282	16.7
Off-site Waste Processing	22,408	4.3
Program Management (including Engineering and Security)	215,875	41.9
Spent Fuel Pool Isolation	9,060	1.8
Spent Fuel Loading/Transfer, EP Fees	24,604	4.8
Insurance and Regulatory Fees	8,052	1.6
Energy	6,405	1.2
Property Taxes	2,553	0.5
Characterization and Licensing Surveys	9,856	1.9
Misc. Equipment and Site Services	5,832	1.1
Total	515,339	100.0

Note: Columns may not add due to rounding

TABLE 6.2

SUMMARY OF DECOMMISSIONING COST ELEMENTS
SAFSTOR
(thousands of 2002 dollars)

Work Category	Cost	Percent of Total
Decontamination	12,989	2.1
Removal	92,366	14.7
Packaging	9,258	1.5
Transportation	2,959	0.5
Waste Disposal	60,031	9.5
Off-site Waste Processing	26,186	4.2
Program Management (including Engineering and Security)	290,055	46.1
Spent Fuel Pool Isolation	9,060	1.4
Spent Fuel Loading/Transfer, EP Fees	24,604	3.9
Insurance and Regulatory Fees	41,433	6.6
Energy	10,173	1.6
Property Taxes	18,602	3.0
Characterization and Licensing Surveys	11,192	1.8
Misc. Equipment and Site Services	19,810	3.2
Total	628,719	100.0

Note: Columns may not add due to rounding

7. REFERENCES

1. U.S. Code of Federal Regulations, Title 10, Parts 30, 40, 50, 51, 70 and 72, "General Requirements for Decommissioning Nuclear Facilities," Nuclear Regulatory Commission, Federal Register Volume 53, Number 123 (p 24018 et seq.), June 27, 1988.

2. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.159, "Assuring the Availability of Funds for Decommissioning Nuclear Reactors," August 1990.

3. U.S. Code of Federal Regulations, Title 10, Parts 2, 50 and 51, "Decommissioning of Nuclear Power Reactors," Nuclear Regulatory Commission, Federal Register Volume 61 (p 39278 et seq.), July 29, 1996.

4. "Nuclear Waste Policy Act of 1982 and Amendments," U.S. Department of Energy's Office of Civilian Radioactive Management, 1982.

5. Maine Yankee Atomic Power Company, Connecticut Yankee Atomic Power Company, and Yankee Atomic Power Company v. United States, U.S. Court of Appeals for the Federal Circuit decision, Docket No. 99-5138, -5139, -5140, August 31, 2000.

6. U.S. Code of Federal Regulations, Title 10, Part 50 – Domestic Licensing of Production and Utilization Facilities, Subpart 54 (bb), "Conditions of Licenses," January 2001 Edition.

7. "Low-Level Radioactive Waste Policy Amendments Act of 1985," Public Law 99-240, January 15, 1986.

8. U.S. Code of Federal Regulations, Title 10, Part 20, Subpart E, "Radiological Criteria for License Termination," Federal Register, Volume 62, Number 139 (p 39058 et seq.), July 21, 1997.

9. "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)," NUREG/CR-1575, EPA 402-R-97-016, December 1997.

10. "Decommissioning Cost Study for the Callaway Plant," Document No. A22-1335-002, TLG Services, Inc., July 1999.

11. T.S. LaGuardia et al., "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," AIF/NESP-036, May 1986.

7. REFERENCES
(continued)

12. W.J. Manion and T.S. LaGuardia, "Decommissioning Handbook," U.S. Department of Energy, DOE/EV/10128-1, November 1980.

13. "Building Construction Cost Data 2002," Robert Snow Means Company, Inc., Kingston, Massachusetts.

14. Project and Cost Engineers' Handbook, Second Edition, p. 239, American Association of Cost Engineers, Marcel Dekker, Inc., New York, New York, 1984.

15. "Strategy for Management and Disposal of Greater-Than-Class C Low-Level Radioactive Waste," Federal Register Volume 60, Number 48 (p 13424 et seq.), March 1995.

16. U.S. Department of Transportation, Section 49 of the Code of Federal Regulations, "Transportation," Parts 173 through 178, 1996.

17. Tri-State Motor Transit Company, published tariffs, Interstate Commerce Commission (ICC), Docket No. MC-109397 and Supplements, 2000.

18. J.C. Evans et al., "Long-Lived Activation Products in Reactor Materials" NUREG/CR-3474, Pacific Northwest Laboratory for the Nuclear Regulatory Commission. August 1984.

19. R.I. Smith, G.J. Konzek, W.E. Kennedy, Jr., "Technology, Safety and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station," NUREG/CR-0130 and addenda, Pacific Northwest Laboratory for the Nuclear Regulatory Commission. June 1978.

20. H.D. Oak, et al., "Technology, Safety and Costs of Decommissioning a Reference Boiling Water Reactor Power Station," NUREG/CR-0672 and addenda, Pacific Northwest Laboratory for the Nuclear Regulatory Commission. June 1980.

21. "Microsoft Project 2000," Microsoft Corporation, Redmond, WA, 1997.

22. "Atomic Energy Act of 1954," (68 Stat. 919).

APPENDIX A

UNIT COST FACTOR DEVELOPMENT

APPENDIX A
UNIT COST FACTOR DEVELOPMENT

Example: Unit Factor for Removal of Contaminated Heat Exchanger < 3,000 lbs.

1. SCOPE

Heat exchangers weighing < 3,000 lbs. will be removed in one piece using a crane or small hoist. They will be disconnected from the inlet and outlet piping. The heat exchanger will be sent to the waste processing area.

2. CALCULATIONS

Act ID	Activity Description	Activity Duration (minutes)	Critical Duration (minutes)*
a	Remove insulation	60	(b)
b	Mount pipe cutters	60	60
c	Install contamination controls	20	(b)
d	Disconnect inlet and outlet lines	60	60
e	Cap openings	20	(d)
f	Rig for removal	30	30
g	Unbolt from mounts	30	30
h	Remove contamination controls	15	15
i	Remove, wrap, send to waste processing area	60	60
	Totals (Activity/Critical)	355	255

Duration adjustment(s):

+ Respiratory protection adjustment (50% of critical duration)	128
+ Radiation/ALARA adjustment (37.08% of critical duration)	95
Adjusted work duration	478
+ Protective clothing adjustment (30% of adjusted duration)	143
Productive work duration	621
+ Work break adjustment (8.33 % of productive duration)	52
Total work duration (minutes)	673

***** Total duration = 11.217 hr *****

* alpha designators indicate activities that can be performed in parallel

APPENDIX A
(continued)

3. LABOR REQUIRED

Crew	Number	Duration (hours)	Rate ($/hr)	Cost
Laborers	3.00	11.217	$27.85	$937.18
Craftsmen	2.00	11.217	$42.94	$963.32
Foreman	1.00	11.217	$44.06	$494.22
General Foreman	0.25	11.217	$45.18	$126.70
Fire Watch	0.05	11.217	$27.85	$15.62
Health Physics Technician	1.00	11.217	$43.10	$483.45
Total labor cost				$3020.49

4. EQUIPMENT & CONSUMABLES COSTS

Equipment Costs	none
Consumables/Materials Costs	
-Blotting paper 50 @ $0.41 sq ft {2}	$20.50
-Plastic sheets/bags 50 @ $0.10/sq ft {3}	$5.00
-Gas torch consumables 1 @ $3.94/hr x 1 hr {1}	$3.94
Subtotal cost of equipment and materials	$29.44
Overhead & sales tax on equipment and materials @ 14.230 %	$4.19
Total costs, equipment & material	$33.63

TOTAL COST:

Removal of contaminated heat exchanger <3000 pounds: $3,054.12

Total labor cost:	$3020.49	
Total equipment/material costs:	$33.63	
Total craft labor man-hours required per unit:		81.88

5. NOTES AND REFERENCES

- Work difficulty factors were developed in conjunction with the AIF (now NEI) program to standardize nuclear decommissioning cost estimates and are delineated in Volume 1, Chapter 5 of the "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," AIF/NESP-036, May 1986.

- References for equipment & consumables costs:

    1. R.S. Means (2002) Section 01590-400-6360 pg 24
    2. www.mcmaster.com online catalog
    3. R.S. Means (2002) Section 01540-800-0200 pg 17

- Material and consumable costs were adjusted using the regional indices for Columbia, Missouri.

APPENDIX B

UNIT COST FACTOR LISTING
(DECON: Power Block Structures Only)

APPENDIX B

UNIT COST FACTOR LISTING
(Power Block Structures Only)

Unit Cost Factor	Cost/Unit($)
Removal of clean instrument and sampling tubing, $/linear foot	0.32
Removal of clean pipe 0.25 to 2 inches diameter, $/linear foot	3.33
Removal of clean pipe >2 to 4 inches diameter, $/linear foot	4.83
Removal of clean pipe >4 to 8 inches diameter, $/linear foot	9.82
Removal of clean pipe >8 to 14 inches diameter, $/linear foot	18.71
Removal of clean pipe >14 to 20 inches diameter, $/linear foot	24.22
Removal of clean pipe >20 to 36 inches diameter, $/linear foot	35.66
Removal of clean pipe >36 inches diameter, $/linear foot	42.42
Removal of clean valves >2 to 4 inches	63.98
Removal of clean valves >4 to 8 inches	98.25
Removal of clean valves >8 to 14 inches	187.06
Removal of clean valves >14 to 20 inches	242.25
Removal of clean valves >20 to 36 inches	356.63
Removal of clean valves >36 inches	424.16
Removal of clean pipe hangers for small bore piping	19.78
Removal of clean pipe hangers for large bore piping	71.98
Removal of clean pumps, <300 pound	163.67
Removal of clean pumps, 300-1000 pound	466.66
Removal of clean pumps, 1000-10,000 pound	1840.65
Removal of clean pumps, >10,000 pound	3,552.45
Removal of clean pump motors, 300-1000 pound	197.52
Removal of clean pump motors, 1000-10,000 pound	768.50
Removal of clean pump motors, >10,000 pound	1,729.12

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)	
Removal of clean heat exchanger <3000 pound	984.52	
Removal of clean heat exchanger >3000 pound	2,468.18	
Removal of clean feedwater heater/deaerator	6,985.04	
Removal of clean moisture separator/reheater	14,396.56	
Removal of clean tanks, <300 gallons	210.79	
Removal of clean tanks, 300-3000 gallon	668.60	
Removal of clean tanks, >3000 gallons, $/square foot surface area	5.69	
Removal of clean electrical equipment, <300 pound	90.58	
Removal of clean electrical equipment, 300-1000 pound	321.59	
Removal of clean electrical equipment, 1000-10,000 pound	643.17	
Removal of clean electrical equipment, >10,000 pound	1,536.09	
Removal of clean electrical transformers < 30 tons	1,066.80	
Removal of clean electrical transformers > 30 tons	3,072.19	
Removal of clean standby diesel-generator, <100 kW		1,089.64
Removal of clean standby diesel-generator, 100 kW to 1 MW	2,432.15	
Removal of clean standby diesel-generator, >1 MW	5,035.03	
Removal of clean electrical cable tray, $/linear foot	8.38	
Removal of clean electrical conduit, $/linear foot	3.65	
Removal of clean mechanical equipment, <300 pound	90.58	
Removal of clean mechanical equipment, 300-1000 pound	321.59	
Removal of clean mechanical equipment, 1000-10,000 pound	643.17	
Removal of clean mechanical equipment, >10,000 pound	1,536.09	
Removal of clean HVAC equipment, <300 pound	90.58	
Removal of clean HVAC equipment, 300-1000 pound		321.59
Removal of clean HVAC equipment, 1000-10,000 pound	643.17	

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)	
Removal of clean HVAC equipment, >10,000 pound	1,536.09	
Removal of clean HVAC ductwork, $/pound	0.34	
Removal of contaminated instrument and sampling tubing, $/linear foot	1.09	
Removal of contaminated pipe 0.25 to 2 inches diameter, $/linear foot	14.03	
Removal of contaminated pipe >2 to 4 inches diameter, $/linear foot	24.55	
Removal of contaminated pipe >4 to 8 inches diameter, $/linear foot	40.52	
Removal of contaminated pipe >8 to 14 inches diameter, $/linear foot	78.71	
Removal of contaminated pipe >14 to 20 inches diameter, $/linear foot	94.68	
Removal of contaminated pipe >20 to 36 inches diameter, $/linear foot	131.47	
Removal of contaminated pipe >36 inches diameter, $/linear foot	155.62	
Removal of contaminated valves >2 to 4 inches	310.33	
Removal of contaminated valves >4 to 8 inches	376.47	
Removal of contaminated valves >8 to 14 inches	758.00	
Removal of contaminated valves >14 to 20 inches	963.95	
Removal of contaminated valves >20 to 36 inches	1,285.57	
Removal of contaminated valves >36 inches	1,527.13	
Removal of contaminated pipe hangers for small bore piping	74.06	
Removal of contaminated pipe hangers for large bore piping	235.63	
Removal of contaminated pumps, <300 pound		668.54
Removal of contaminated pumps, 300-1000 pound	1,561.14	
Removal of contaminated pumps, 1000-10,000 pound	5,016.51	
Removal of contaminated pumps, >10,000 pound	12,216.97	
Removal of contaminated pump motors, 300-1000 pound	659.87	
Removal of contaminated pump motors, 1000-10,000 pound		2,039.51
Removal of contaminated pump motors, >10,000 pound	4,578.90	

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated heat exchanger <3000 pound	3,054.12
Removal of contaminated heat exchanger >3000 pound	8,827.69
Removal of contaminated tanks, <300 gallons	1,110.98
Removal of contaminated tanks, >300 gallons, $/square foot	22.00
Removal of contaminated electrical equipment, <300 pound	522.47
Removal of contaminated electrical equipment, 300-1000 pound	1,271.34
Removal of contaminated electrical equipment, 1000-10,000 pound	2,447.34
Removal of contaminated electrical equipment, >10,000 pound	4,777.88
Removal of contaminated electrical cable tray, $/linear foot	25.13
Removal of contaminated electrical conduit, $/linear foot	11.42
Removal of contaminated mechanical equipment, <300 pound	581.77
Removal of contaminated mechanical equipment, 300-1000 pound	1,405.97
Removal of contaminated mechanical equipment, 1000-10,000 pound	2,702.16
Removal of contaminated mechanical equipment, >10,000 pound	4,777.88
Removal of contaminated HVAC equipment, <300 pound	581.77
Removal of contaminated HVAC equipment, 300-1000 pound	1,405.97
Removal of contaminated HVAC equipment, 1000-10,000 pound	2,702.16
Removal of contaminated HVAC equipment, >10,000 pound	4,777.88
Removal of contaminated HVAC ductwork, $/pound	2.35
Removal/plasma arc cut of contaminated thin metal components, $/linear in.	2.75
Additional decontamination of surface by washing, $/square foot	5.47

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)	
Additional decontamination of surfaces by hydrolasing, $/square foot	26.33	
Decontamination rig hook-up and flush		4,944.11
Chemical flush of components/systems, $/gallon	9.69	
Removal of clean standard reinforced concrete, $/cubic yard	53.47	
Removal of grade slab concrete, $/cubic yard	157.12	
Removal of clean concrete floors, $/cubic yard	241.11	
Removal of sections of clean concrete floors, $/cubic yard	716.47	
Removal of clean heavily rein concrete w/#9 rebar, $/cubic yard	163.32	
Removal of contaminated heavily rein concrete w/#9 rebar, $/cubic yard	1,434.59	
Removal of clean heavily rein concrete w/#18 rebar, $/cubic yard	206.59	
Removal of contaminated heavily rein concrete w/#18 rebar, $/cubic yard	1,899.46	
Removal heavily rein concrete w/#18 rebar & steel embedments, $/cu yd	309.86	
Removal of below-grade suspended floors, $/cubic yard	241.11	
Removal of clean monolithic concrete structures, $/cubic yard	596.98	
Removal of contaminated monolithic concrete structures, $/cubic yard	1,434.21	
Removal of clean foundation concrete, $/cubic yard	467.14	
Removal of contaminated foundation concrete, $/cubic yard	1,335.71	
Explosive demolition of bulk concrete, $/cubic yard	21.67	
Removal of clean hollow masonry block wall, $/cubic yard	55.71	
Removal of contaminated hollow masonry block wall, $/cubic yard	200.12	
Removal of clean solid masonry block wall, $/cubic yard	55.71	
Removal of contaminated solid masonry block wall, $/cubic yard	200.12	
Backfill of below-grade voids, $/cubic yard	14.19	
Removal of subterranean tunnels/voids, $/linear foot	100.58	
Placement of concrete for below-grade voids, $/cubic yard	82.68	

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)
Excavation of clean material, $/cubic yard	2.45
Excavation of contaminated material, $/cubic yard	29.60
Excavation of submerged concrete rubble, $/cubic yard	9.77
Removal of clean concrete rubble (tipping fee included), $/cubic yard	66.66
Removal of contaminated concrete rubble, $/cubic yard	22.95
Removal of building by volume, $/cubic foot	0.20
Removal of clean building metal siding, $/square foot	0.95
Removal of contaminated building metal siding, $/square foot	3.36
Removal of standard asphalt roofing, $/square foot	1.50
Removal of transite panels, $/square foot	1.66
Scarifying contaminated concrete surfaces (drill & spall)	9.98
Scabbling contaminated concrete floors, $/square foot	5.67
Scabbling contaminated concrete walls, $/square foot	6.24
Scabbling contaminated ceilings, $/square foot	56.12
Scabbling structural steel, $/square foot	4.88
Removal of clean overhead cranes/monorails < 10 ton capacity	459.57
Removal of contaminated overhead cranes/monorails < 10 ton capacity	1,346.91
Removal of clean overhead cranes/monorails >10-50 ton capacity	1,102.97
Removal of contaminated overhead cranes/monorails >10-50 ton capacity	3,232.02
Removal of polar cranes > 50 ton capacity, each	4,616.01
Removal of gantry cranes > 50 ton capacity, each	19,201.16
Removal of structural steel, $/pound	0.26
Removal of clean steel floor grating, $/square foot	2.30
Removal of contaminated steel floor grating, $/square foot	7.41
Removal of clean free-standing steel liner, $/square foot	8.54

APPENDIX B
(continued)

Unit Cost Factor	Cost/Unit($)
Removal of contaminated free-standing steel liner, $/square foot	25.75
Removal of clean concrete-anchored steel liner, $/square foot	4.27
Removal of contaminated concrete-anchored steel liner, $/square foot	29.99
Placement of scaffolding in clean areas, $/square foot	11.11
Placement of scaffolding in contaminated areas, $/square foot	17.57
Landscaping with topsoil, $/acre	13,311.35
Cost of CPC B-88 LSA box & preparation for use	1,276.22
Cost of CPC B-25 LSA box & preparation for use	1,163.70
Cost of CPC B-12V 12 gauge LSA box & preparation for use	1,034.62
Cost of CPC B-144 LSA box & preparation for use	4,767.26
Cost of LSA drum & preparation for use	99.99
Cost of cask liner for CNSI 14-195 cask	7,866.77
Cost of cask liner for CNSI 8-120A cask (resins)	5,338.02
Cost of cask liner for CNSI 8-120A cask (filters)	5,338.02
Decontamination of surfaces with vacuuming, $/square foot	0.48

APPENDIX C

DECON DECOMMISSIONING COST ESTIMATE

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2002 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
PERIOD 1a - Shutdown through Transition																					
Period 1a Direct Decommissioning Activities																					
1a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	95	14	110	110	-	-	-	-	-	-	-	-	-	1,300
1a.1.2	Notification of Cessation of Operations									a											
1a.1.3	Remove fuel & source material									n/a											
1a.1.4	Notification of Permanent Defueling									a											
1a.1.5	Deactivate plant systems & process waste									a											
1a.1.6	Prepare and submit PSDAR	-	-	-	-	-	-	147	22	169	169	-	-	-	-	-	-	-	-	-	2,000
1a.1.7	Review plant dwgs & specs.	-	-	-	-	-	-	337	51	388	388	-	-	-	-	-	-	-	-	-	4,600
1a.1.8	Perform detailed rad survey									a											
1a.1.9	Estimate by-product inventory	-	-	-	-	-	-	73	11	84	84	-	-	-	-	-	-	-	-	-	1,000
1a.1.10	End product description	-	-	-	-	-	-	73	11	84	84	-	-	-	-	-	-	-	-	-	1,000
1a.1.11	Detailed by-product inventory	-	-	-	-	-	-	95	14	110	110	-	-	-	-	-	-	-	-	-	1,300
1a.1.12	Define major work sequence	-	-	-	-	-	-	550	82	632	632	-	-	-	-	-	-	-	-	-	7,500
1a.1.13	Perform SER and EA	-	-	-	-	-	-	227	34	261	261	-	-	-	-	-	-	-	-	-	3,100
1a.1.14	Perform Site-Specific Cost Study	-	-	-	-	-	-	367	55	422	422	-	-	-	-	-	-	-	-	-	5,000
1a.1.15	Prepare/submit License Termination Plan	-	-	-	-	-	-	300	45	345	345	-	-	-	-	-	-	-	-	-	4,096
1a.1.16	Receive NRC approval of termination plan									a											
Activity Specifications																					
1a.1.17.1	Plant & temporary facilities	-	-	-	-	-	-	361	54	415	373	-	41	-	-	-	-	-	-	-	4,920
1a.1.17.2	Plant systems	-	-	-	-	-	-	306	46	351	316	-	35	-	-	-	-	-	-	-	4,167
1a.1.17.3	NSSS Decontamination Flush	-	-	-	-	-	-	37	5	42	42	-	-	-	-	-	-	-	-	-	500
1a.1.17.4	Reactor internals	-	-	-	-	-	-	521	78	599	599	-	-	-	-	-	-	-	-	-	7,100
1a.1.17.5	Reactor vessel	-	-	-	-	-	-	477	71	548	548	-	-	-	-	-	-	-	-	-	6,500
1a.1.17.6	Biological shield	-	-	-	-	-	-	37	5	42	42	-	-	-	-	-	-	-	-	-	500
1a.1.17.7	Steam generators	-	-	-	-	-	-	229	34	263	263	-	-	-	-	-	-	-	-	-	3,120
1a.1.17.8	Reinforced concrete	-	-	-	-	-	-	117	18	135	67	-	67	-	-	-	-	-	-	-	1,600
1a.1.17.9	Turbine & condenser	-	-	-	-	-	-	59	9	67	-	-	67	-	-	-	-	-	-	-	800
1a.1.17.10	Plant structures & buildings	-	-	-	-	-	-	229	34	263	132	-	132	-	-	-	-	-	-	-	3,120
1a.1.17.11	Waste management	-	-	-	-	-	-	337	51	388	388	-	-	-	-	-	-	-	-	-	4,600
1a.1.17.12	Facility & site closeout	-	-	-	-	-	-	66	10	76	38	-	38	-	-	-	-	-	-	-	900
1a.1.17	Total	-	-	-	-	-	-	2,774	416	3,190	2,809	-	381	-	-	-	-	-	-	-	37,827
Planning & Site Preparations																					
1a.1.18	Prepare dismantling sequence	-	-	-	-	-	-	176	26	202	202	-	-	-	-	-	-	-	-	-	2,400
1a.1.19	Plant prep. & temp. svces	-	-	-	-	-	-	2,304	346	2,650	2,650	-	-	-	-	-	-	-	-	-	-
1a.1.20	Design water clean-up system	-	-	-	-	-	-	103	15	118	118	-	-	-	-	-	-	-	-	-	1,400
1a.1.21	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	1,950	293	2,243	2,243	-	-	-	-	-	-	-	-	-	-
1a.1.22	Procure casks/liners & containers	-	-	-	-	-	-	90	14	104	104	-	-	-	-	-	-	-	-	-	1,230
1a.1	Subtotal Period 1a Activity Costs	-	-	-	-	-	-	9,662	1,449	11,112	10,731	-	381	-	-	-	-	-	-	-	73,753
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	1,378	138	1,516	1,516	-	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	-	275	27	302	302	-	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	212	-	-	-	-	-	53	265	265	-	-	-	-	-	-	-	-	-	-
1a.4.4	Heavy equipment rental	-	296	-	-	-	-	-	44	340	340	-	-	-	-	-	-	-	-	-	-
1a.4.5	Disposal of DAW generated	-	-	6	1	-	28	-	8	43	43	-	-	-	404	-	-	-	8,103	99	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	871	131	1,001	1,001	-	-	-	-	-	-	-	-	-	-
1a.4.7	NRC Fees	-	-	-	-	-	-	328	33	361	361	-	-	-	-	-	-	-	-	-	-
1a.4.8	Emergency Planning Fees	-	-	-	-	-	-	101	10	111	-	111	-	-	-	-	-	-	-	-	-
1a.4.9	Transferal of spent fuel to DOE	-	-	-	-	-	-	3,000	300	3,300	-	3,300	-	-	-	-	-	-	-	-	-
1a.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	940	141	1,082	-	1,082	-	-	-	-	-	-	-	-	-
1a.4.11	Security Staff Cost	-	-	-	-	-	-	1,483	222	1,705	1,705	-	-	-	-	-	-	-	-	-	58,921
1a.4.12	Utility Staff Cost	-	-	-	-	-	-	22,360	3,354	25,714	25,714	-	-	-	-	-	-	-	-	-	440,086
1a.4	Subtotal Period 1a Period-Dependent Costs	-	507	6	1	-	28	30,736	4,461	35,741	31,248	4,493	-	-	404	-	-	-	8,103	99	499,007
1a.0	TOTAL PERIOD 1a COST	-	507	6	1	-	28	40,399	5,911	46,852	41,979	4,493	381	-	404	-	-	-	8,103	99	572,760
PERIOD 1b - Decommissioning Preparations																					
Period 1b Direct Decommissioning Activities																					
Detailed Work Procedures																					
1b.1.1.1	Plant systems	-	-	-	-	-	-	347	52	399	359	-	40	-	-	-	-	-	-	-	4,733
1b.1.1.2	NSSS Decontamination Flush	-	-	-	-	-	-	73	11	84	84	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.3	Reactor internals	-	-	-	-	-	-	183	27	211	211	-	-	-	-	-	-	-	-	-	2,500
1b.1.1.4	Remaining buildings	-	-	-	-	-	-	99	15	114	28	-	85	-	-	-	-	-	-	-	1,350
1b.1.1.5	CRD cooling assembly	-	-	-	-	-	-	73	11	84	84	-	-	-	-	-	-	-	-	-	1,000

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2002 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
1b.1.1.6	CRD housings & ICI tubes	-	-	-	-	-	-	73	11	84	84	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.7	Incore instrumentation	-	-	-	-	-	-	73	11	84	84	-	-	-	-	-	-	-	-	-	1,000
1b.1.1.8	Reactor vessel	-	-	-	-	-	-	266	40	306	306	-	-	-	-	-	-	-	-	-	3,630
1b.1.1.9	Facility closeout	-	-	-	-	-	-	88	13	101	51	-	51	-	-	-	-	-	-	-	1,200
1b.1.1.10	Missile shields	-	-	-	-	-	-	33	5	38	38	-	-	-	-	-	-	-	-	-	450
1b.1.1.11	Biological shield	-	-	-	-	-	-	88	13	101	101	-	-	-	-	-	-	-	-	-	1,200
1b.1.1.12	Steam generators	-	-	-	-	-	-	337	51	388	388	-	-	-	-	-	-	-	-	-	4,600
1b.1.1.13	Reinforced concrete	-	-	-	-	-	-	73	11	84	42	-	42	-	-	-	-	-	-	-	1,000
1b.1.1.14	Turbine & condensers	-	-	-	-	-	-	229	34	263	-	-	263	-	-	-	-	-	-	-	3,120
1b.1.1.15	Auxiliary building	-	-	-	-	-	-	200	30	230	207	-	23	-	-	-	-	-	-	-	2,730
1b.1.1.16	Reactor building	-	-	-	-	-	-	200	30	230	207	-	23	-	-	-	-	-	-	-	2,730
1b.1.1	Total	-	-	-	-	-	-	2,438	366	2,803	2,276	-	527	-	-	-	-	-	-	-	33,243
1b.1.2	Decon primary loop	872	-	-	-	-	-	-	436	1,307	1,307	-	-	-	-	-	-	-	-	1,067	-
1b.1	Subtotal Period 1b Activity Costs	872	-	-	-	-	-	2,438	801	4,111	3,584	-	527	-	-	-	-	-	-	1,067	33,243
Period 1b Additional Costs																					
1b.2.1	Spent Fuel Pool Isolation	-	-	-	-	-	-	7,879	1,182	9,060	9,060	-	-	-	-	-	-	-	-	-	-
1b.2.2	Site Characterization	-	-	-	-	-	-	1,463	439	1,901	1,901	-	-	-	-	-	-	-	-	-	-
1b.2	Subtotal Period 1b Additional Costs	-	-	-	-	-	-	9,341	1,621	10,962	10,962	-	-	-	-	-	-	-	-	-	-
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	603	-	-	-	-	-	-	90	693	693	-	-	-	-	-	-	-	-	-	-
1b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	753	113	866	866	-	-	-	-	-	-	-	-	-	-
1b.3.3	Process liquid waste	56	-	386	532	-	4,499	-	1,271	6,744	6,744	-	-	-	-	5,381	-	-	890,864	197	-
1b.3.4	Small tool allowance	-	1	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	-	-
1b.3.5	Pipe cutting equipment	-	911	-	-	-	-	-	137	1,048	1,048	-	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	659	912	386	532	-	4,499	753	1,611	9,352	9,352	-	-	-	-	5,381	-	-	890,864	197	-
Period 1b Period-Dependent Costs																					
1b.4.1	Decon supplies	19	-	-	-	-	-	-	5	23	23	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	695	69	764	764	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	139	14	152	152	-	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	110	-	-	-	-	-	28	138	138	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	149	-	-	-	-	-	22	171	171	-	-	-	-	-	-	-	-	-	-
1b.4.6	Disposal of DAW generated	-	-	3	1	-	15	-	4	24	24	-	-	-	220	-	-	-	4,416	54	-
1b.4.7	Plant energy budget	-	-	-	-	-	-	606	91	697	697	-	-	-	-	-	-	-	-	-	-
1b.4.8	NRC Fees	-	-	-	-	-	-	196	20	216	216	-	-	-	-	-	-	-	-	-	-
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	51	5	56	-	56	-	-	-	-	-	-	-	-	-
1b.4.10	Transferal of spent fuel to DOE	-	-	-	-	-	-	1,400	140	1,540	-	1,540	-	-	-	-	-	-	-	-	-
1b.4.11	Spent Fuel Pool O&M	-	-	-	-	-	-	474	71	545	-	545	-	-	-	-	-	-	-	-	-
1b.4.12	Security Staff Cost	-	-	-	-	-	-	747	112	860	860	-	-	-	-	-	-	-	-	-	29,703
1b.4.13	DOC Staff Cost	-	-	-	-	-	-	4,605	691	5,296	5,296	-	-	-	-	-	-	-	-	-	68,343
Period 1b Period-Dependent Costs (continued)																					
1b.4.14	Utility Staff Cost	-	-	-	-	-	-	11,272	1,691	12,963	12,963	-	-	-	-	-	-	-	-	-	221,851
1b.4	Subtotal Period 1b Period-Dependent Costs	19	259	3	1	-	15	20,185	2,963	23,445	21,304	2,141	-	-	220	-	-	-	4,416	54	319,897
1b.0	TOTAL PERIOD 1b COST	1,549	1,171	389	532	-	4,514	32,718	6,996	47,870	45,202	2,141	527	-	220	5,381	-	-	895,280	1,317	353,140
PERIOD 1 TOTALS		1,549	1,679	396	534	-	4,542	73,116	12,907	94,722	87,180	6,634	908	-	625	5,381	-	-	903,383	1,417	925,900
PERIOD 2a - Large Component Removal																					
Period 2a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
2a.1.1.1	Reactor Coolant Piping	139	137	19	20	-	707	-	285	1,307	1,307	-	-	-	1,534	-	-	-	139,959	6,847	-
2a.1.1.2	Pressurizer Relief Tank	23	20	4	4	-	184	-	64	298	298	-	-	-	328	-	-	-	36,395	525	-
2a.1.1.3	Reactor Coolant Pumps & Motors	71	67	35	56	139	3,416	-	939	4,723	4,723	-	-	198	2,556	-	-	-	833,107	3,772	-
2a.1.1.4	Pressurizer	35	22	448	133	-	1,217	-	392	2,247	2,247	-	-	-	2,426	-	-	-	269,001	2,862	-
2a.1.1.5	Steam Generators	295	3,740	3,184	907	2,597	10,699	-	4,601	26,022	26,022	-	-	20,192	17,453	-	-	-	2,401,813	23,227	-
2a.1.1.6	CRDMs/ICIs/Service Structure Removal	118	76	105	22	-	434	-	200	955	955	-	-	-	3,881	-	-	-	86,025	4,564	-
2a.1.1.7	Reactor Vessel Internals	93	2,094	2,636	661	-	5,658	191	5,299	16,631	16,631	-	-	-	1,377	412	861	-	314,544	27,817	1,245
2a.1.1.8	Vessel & Internals GTCC Disposal	-	-	-	-	-	12,646	-	1,897	14,543	14,543	-	-	-	-	-	-	652	-	-	-
2a.1.1.9	Reactor Vessel	66	4,183	1,294	428	-	8,185	191	7,722	22,069	22,069	-	-	-	7,750	2,128	-	-	1,069,368	27,817	1,245
2a.1.1	Totals	840	10,339	7,725	2,229	2,736	43,146	382	21,399	88,795	88,795	-	-	20,390	37,305	2,541	861	652	5,150,212	97,431	2,489
Removal of Major Equipment																					
2a.1.2	Main Turbine/Generator	-	118	-	-	-	-	-	18	135	-	-	135	-	-	-	-	-	-	3,091	-
2a.1.3	Main Condensers	-	390	-	-	-	-	-	59	449	-	-	449	-	-	-	-	-	-	10,143	-

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2002 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
Disposal of Plant Systems																					
2a.1.4.1	100 Aux.Bldg Non-System Specific RCA	-	511	9	8	666	-	-	230	1,423	1,423	-	-	6,196	-	-	-	-	-	13,466	-
2a.1.4.2	100 Auxiliary Bldg Non-System Specific	-	85	3	1	41	90	-	51	272	272	-	-	385	199	-	-	-	17,853	2,280	-
2a.1.4.3	AB - Main Steam	-	192	-	-	-	-	-	29	221	-	-	221	-	-	-	-	-	-	5,833	-
2a.1.4.4	AB - Main Steam RCA	-	57	2	2	188	-	-	43	293	293	-	-	1,751	-	-	-	-	-	1,494	-
2a.1.4.5	AC - Main Turbine	-	190	-	-	-	-	-	28	218	-	-	218	-	-	-	-	-	-	5,641	-
2a.1.4.6	AD - Condensate	-	212	-	-	-	-	-	32	244	-	-	244	-	-	-	-	-	-	6,144	-
2a.1.4.7	AE - Feedwater	-	145	-	-	-	-	-	22	167	-	-	167	-	-	-	-	-	-	4,271	-
2a.1.4.8	AF - Feedwater Heater Extraction	-	177	-	-	-	-	-	27	203	-	-	203	-	-	-	-	-	-	5,352	-
2a.1.4.9	AK - Condensate Demineralizer	-	65	-	-	-	-	-	10	75	-	-	75	-	-	-	-	-	-	1,944	-
2a.1.4.10	AL - Auxiliary Feedwater	-	28	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	852	-
2a.1.4.11	AQ - Condensate & Feedwater Chem Addtn	-	16	-	-	-	-	-	2	18	-	-	18	-	-	-	-	-	-	468	-
2a.1.4.12	BM - Steam Generator Blowdown	-	83	3	1	78	61	-	48	275	275	-	-	725	140	-	-	-	12,066	2,220	-
2a.1.4.13	BM - Steam Generator Blowdown - RCA	-	261	5	4	359	-	-	120	749	749	-	-	3,337	-	-	-	-	-	6,846	-
2a.1.4.14	BN - Borated Refueling Water Storage	-	257	11	7	481	170	-	181	1,108	1,108	-	-	4,477	416	-	-	-	33,735	6,817	-
2a.1.4.15	CA - Steam Seal	-	15	-	-	-	-	-	2	17	-	-	17	-	-	-	-	-	-	455	-
2a.1.4.16	CB - Main Turbine Lube Oil	-	44	-	-	-	-	-	7	50	-	-	50	-	-	-	-	-	-	1,207	-
2a.1.4.17	CC - Generator Hydrogen Seal & CO2	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	198	-
2a.1.4.18	CD - Generator Seal Oil	-	10	-	-	-	-	-	1	11	-	-	11	-	-	-	-	-	-	287	-
2a.1.4.19	CE - Stator Cooling Water	-	9	-	-	-	-	-	1	10	-	-	10	-	-	-	-	-	-	241	-
2a.1.4.20	CF - Lube Oil Storage Xfer & Prfication	-	27	-	-	-	-	-	4	32	-	-	32	-	-	-	-	-	-	812	-
2a.1.4.21	CG - Condenser Air Removal	-	22	-	-	-	-	-	3	26	-	-	26	-	-	-	-	-	-	657	-
2a.1.4.22	CH - Main Turbine Control Oil	-	45	-	-	-	-	-	7	51	-	-	51	-	-	-	-	-	-	1,219	-
2a.1.4.23	DA - Circulating Water	-	249	-	-	-	-	-	37	287	-	-	287	-	-	-	-	-	-	7,502	-
2a.1.4.24	DB - Cooling Tower Makeup & Blowdown	-	42	-	-	-	-	-	6	49	-	-	49	-	-	-	-	-	-	1,260	-
2a.1.4.25	DD - Cooling Water Chemical Control Sys	-	37	-	-	-	-	-	6	42	-	-	42	-	-	-	-	-	-	1,073	-
2a.1.4.26	DD - Cooling Wtr Chem Control RCA	-	195	4	4	310	-	-	96	610	610	-	-	2,888	-	-	-	-	-	4,864	-
2a.1.4.27	EJ - Residual Heat Removal	-	279	26	9	240	772	-	303	1,628	1,628	-	-	2,228	1,715	-	-	-	152,794	7,549	-
2a.1.4.28	EM - High Pressure Coolant Injection	-	216	9	3	115	207	-	124	674	674	-	-	1,068	458	-	-	-	41,038	5,792	-
Disposal of Plant Systems (continued)																					
2a.1.4.29	EN - Containment Spray	-	152	3	3	264	-	-	78	501	501	-	-	2,457	-	-	-	-	-	4,003	-
2a.1.4.30	EP - Accumulator Safety Injection	-	121	5	2	140	90	-	75	433	433	-	-	1,298	208	-	-	-	17,878	3,207	-
2a.1.4.31	FA - Auxiliary Steam Generator	-	17	-	-	-	-	-	3	19	-	-	19	-	-	-	-	-	-	521	-
2a.1.4.32	FB - Auxiliary Steam	-	69	-	-	-	-	-	10	80	-	-	80	-	-	-	-	-	-	2,106	-
2a.1.4.33	FB - Auxiliary Steam RCA	-	58	1	1	71	-	-	25	156	156	-	-	663	-	-	-	-	-	1,491	-
2a.1.4.34	FC - Auxiliary Turbines	-	45	-	-	-	-	-	7	52	-	-	52	-	-	-	-	-	-	1,320	-
2a.1.4.35	FE - Auxiliary Steam Chemical Addition	-	4	-	-	-	-	-	1	4	-	-	4	-	-	-	-	-	-	105	-
2a.1.4.36	GE - Turbine Building HVAC	-	122	-	-	-	-	-	18	140	-	-	140	-	-	-	-	-	-	3,792	-
2a.1.4.37	GS - Containment Hydrogen Control	-	55	2	1	57	33	-	31	179	179	-	-	535	73	-	-	-	6,573	1,464	-
2a.1.4.38	HE - Boron Recycle	288	347	19	6	227	451	-	380	1,719	1,719	-	-	2,112	1,111	-	-	-	89,323	15,830	-
2a.1.4.39	HF - Secondary Liquid Waste	529	701	43	15	540	1,024	-	783	3,634	3,634	-	-	5,024	2,522	-	-	-	202,738	30,612	-
2a.1.4.40	JA - Auxiliary Oil & Transfer	-	23	-	-	-	-	-	3	26	-	-	26	-	-	-	-	-	-	687	-
2a.1.4.41	KS - Bulk Chemical Storage	-	68	7	6	563	-	-	103	747	747	-	-	5,238	-	-	-	-	-	1,805	-
2a.1.4.42	LE - Oily Waste	-	129	-	-	-	-	-	19	148	-	-	148	-	-	-	-	-	-	3,865	-
2a.1.4.43	LE - Oily Waste RCA	-	165	3	2	197	-	-	71	439	439	-	-	1,833	-	-	-	-	-	4,179	-
2a.1.4.44	Turbine Bldg Non-System Specific	-	543	-	-	-	-	-	81	624	-	-	624	-	-	-	-	-	-	15,405	-
2a.1.4	Totals	817	6,095	156	77	4,538	2,899	-	3,116	17,697	14,839	-	2,857	42,215	6,842	-	-	-	573,998	187,137	-
2a.1.5	Scaffolding in support of decommissioning	-	1,001	15	2	119	22	-	275	1,434	1,434	-	-	1,110	77	-	-	-	6,886	30,578	-
2a.1	Subtotal Period 2a Activity Costs	1,656	17,943	7,896	2,308	7,393	46,067	382	24,866	108,510	105,069	-	3,441	63,715	44,224	2,541	861	652	5,731,095	328,379	2,489
Period 2a Additional Costs																					
2a.2.1	Curie Surcharge (Excluding RPV)	-	-	-	-	-	2,495	-	624	3,118	3,118	-	-	-	-	-	-	-	-	-	-
2a.2	Subtotal Period 2a Additional Costs	-	-	-	-	-	2,495	-	624	3,118	3,118	-	-	-	-	-	-	-	-	-	-
Period 2a Collateral Costs																					
2a.3.1	Process liquid waste	180	-	88	222	-	1,171	-	425	2,086	2,086	-	-	-	-	1,693	-	-	231,803	258	-
2a.3.2	Small tool allowance	-	194	-	-	-	-	-	29	223	201	-	22	-	-	-	-	-	-	-	-
2a.3	Subtotal Period 2a Collateral Costs	180	194	88	222	-	1,171	-	454	2,310	2,287	-	22	-	-	1,693	-	-	231,803	258	-
Period 2a Period-Dependent Costs																					
2a.4.1	Decon supplies	56	-	-	-	-	-	-	14	70	70	-	-	-	-	-	-	-	-	-	-
2a.4.2	Insurance	-	-	-	-	-	-	690	69	760	760	-	-	-	-	-	-	-	-	-	-
2a.4.3	Property taxes	-	-	-	-	-	-	416	42	458	412	-	46	-	-	-	-	-	-	-	-
2a.4.4	Health physics supplies	-	1,275	-	-	-	-	-	319	1,594	1,594	-	-	-	-	-	-	-	-	-	-
2a.4.5	Heavy equipment rental	-	2,424	-	-	-	-	-	364	2,788	2,788	-	-	-	-	-	-	-	-	-	-
2a.4.6	Disposal of DAW generated	-	-	79	16	-	352	-	98	545	545	-	-	-	5,085	-	-	-	101,896	1,248	-
2a.4.7	Plant energy budget	-	-	-	-	-	-	1,237	186	1,423	1,423	-	-	-	-	-	-	-	-	-	-
2a.4.8	NRC Fees	-	-	-	-	-	-	528	53	580	580	-	-	-	-	-	-	-	-	-	-
2a.4.9	Emergency Planning Fees	-	-	-	-	-	-	153	15	168	-	168	-	-	-	-	-	-	-	-	-

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2002 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
2a.4.10	Transferal of spent fuel to DOE	-	-	-	-	-	-	4,600	460	5,060	-	5,060	-	-	-	-	-	-	-	-	-
2a.4.11	Spent Fuel Pool O&M	-	-	-	-	-	-	1,425	214	1,639	-	1,639	-	-	-	-	-	-	-	-	-
2a.4.12	Security Staff Cost	-	-	-	-	-	-	2,803	420	3,223	3,223	-	-	-	-	-	-	-	-	-	111,390
2a.4.13	DOC Staff Cost	-	-	-	-	-	-	16,383	2,458	18,841	18,841	-	-	-	-	-	-	-	-	-	246,480
2a.4.14	Utility Staff Cost	-	-	-	-	-	-	18,510	2,776	21,286	21,286	-	-	-	-	-	-	-	-	-	345,230
2a.4	Subtotal Period 2a Period-Dependent Costs	56	3,699	79	16	-	352	46,745	7,487	58,434	51,522	6,867	46	-	5,085	-	-	-	101,896	1,248	703,100
2a.0	TOTAL PERIOD 2a COST	1,892	21,836	8,063	2,547	7,393	50,083	47,127	33,431	172,372	161,996	6,867	3,509	63,715	49,309	4,233	861	652	6,064,795	329,885	705,589
PERIOD 2b - Site Decontamination																					
Period 2b Direct Decommissioning Activities																					
Disposal of Plant Systems																					
2b.1.1.1	200 Reactor Bldg Non-System Specific	-	67	2	1	24	59	-	35	188	188	-	-	219	131	-	-	-	11,756	1,758	-
2b.1.1.2	200 Reactor Bldg Non-System Specific RCA	-	404	5	5	416	-	-	165	995	995	-	-	3,872	-	-	-	-	-	10,422	-
2b.1.1.3	300 Control Bldg Non-System Specific	-	130	2	2	187	-	-	61	383	383	-	-	1,737	-	-	-	-	-	3,412	-
2b.1.1.4	300 Control Bldg Non-System Specific Cln	-	1,071	-	-	-	-	-	161	1,232	-	-	1,232	-	-	-	-	-	-	29,076	-
2b.1.1.5	700 Radwaste Bldg Non-Sys Specific RCA	-	834	14	13	1,107	-	-	378	2,346	2,346	-	-	10,302	-	-	-	-	-	21,912	-
2b.1.1.6	700 Radwaste Bldg Non-System Specific	-	137	5	2	62	159	-	84	448	448	-	-	573	351	-	-	-	31,456	3,649	-
2b.1.1.7	AN - Demineralized Wtr Storage & Xfer	-	108	-	-	-	-	-	16	124	-	-	124	-	-	-	-	-	-	3,283	-
2b.1.1.8	AN - Demineralized Wtr Strg & Xfer RCA	-	28	0	0	27	-	-	11	67	67	-	-	255	-	-	-	-	-	711	-
2b.1.1.9	AP - Condensate Storage & Transfer	-	65	-	-	-	-	-	10	75	-	-	75	-	-	-	-	-	-	1,794	-
2b.1.1.10	BB - Reactor Coolant System	-	228	20	6	158	539	-	218	1,170	1,170	-	-	1,472	1,399	-	-	-	106,703	6,250	-
2b.1.1.11	BG - Chemical & Volume Control	524	646	56	18	431	1,576	-	890	4,139	4,139	-	-	4,005	3,562	-	-	-	312,006	26,124	-
2b.1.1.12	BL - Reactor Makeup Water	-	214	12	4	168	272	-	149	819	819	-	-	1,566	700	-	-	-	53,782	5,683	-
2b.1.1.13	DE - Intake & Water Treatment	-	434	-	-	-	-	-	65	499	-	-	499	-	-	-	-	-	-	12,917	-
2b.1.1.14	DE - Intake & Water Treatment RCA	-	186	14	12	1,041	-	-	206	1,459	1,459	-	-	9,684	-	-	-	-	-	4,986	-
2b.1.1.15	EA - Service Water	-	104	-	-	-	-	-	16	120	-	-	120	-	-	-	-	-	-	3,145	-
2b.1.1.16	EA - Service Water RCA	-	32	1	1	109	-	-	25	169	169	-	-	1,014	-	-	-	-	-	828	-
2b.1.1.17	EB - Closed Cooling Water	-	41	-	-	-	-	-	6	48	-	-	48	-	-	-	-	-	-	1,267	-
2b.1.1.18	EF - Essential Service Water	-	241	-	-	-	-	-	36	277	-	-	277	-	-	-	-	-	-	7,244	-
2b.1.1.19	EF - Essential Service Water RCA	-	144	6	5	465	-	-	107	727	727	-	-	4,326	-	-	-	-	-	3,799	-
2b.1.1.20	EG - Component Cooling Water RCA	-	175	-	-	-	-	-	26	201	-	-	201	-	-	-	-	-	-	5,335	-
2b.1.1.21	GA - Plant Heating	-	62	-	-	-	-	-	9	71	-	-	71	-	-	-	-	-	-	1,912	-
2b.1.1.22	GA - Plant Heating RCA	-	66	1	1	56	-	-	25	148	148	-	-	518	-	-	-	-	-	1,697	-
2b.1.1.23	GB - Central Chilled Water	-	58	-	-	-	-	-	9	67	-	-	67	-	-	-	-	-	-	1,803	-
2b.1.1.24	GB - Central Chilled Water RCA	-	18	0	0	16	-	-	7	42	42	-	-	152	-	-	-	-	-	463	-
2b.1.1.25	GD - Essential Serv Wtr Pumphouse HVAC	-	13	-	-	-	-	-	2	15	-	-	15	-	-	-	-	-	-	414	-
2b.1.1.26	GF - Miscellaneous Building HVAC	-	129	2	2	178	-	-	60	371	371	-	-	1,652	-	-	-	-	-	2,884	-
2b.1.1.27	GH - Radwaste Building HVAC	-	200	4	3	212	31	-	90	539	539	-	-	1,969	69	-	-	-	6,195	4,781	-
2b.1.1.28	GK - Control Building HVAC	-	122	-	-	-	-	-	18	141	-	-	141	-	-	-	-	-	-	3,900	-
2b.1.1.29	GL - Auxiliary Building HVAC	-	506	8	6	442	73	-	213	1,247	1,247	-	-	4,113	161	-	-	-	14,431	12,054	-
2b.1.1.30	GM - Diesel Generator Building HVAC	-	21	-	-	-	-	-	3	25	-	-	25	-	-	-	-	-	-	692	-
2b.1.1.31	GN - Containment Cooling	-	496	14	9	643	206	-	275	1,642	1,642	-	-	5,984	454	-	-	-	40,723	12,102	-
2b.1.1.32	GP - Containment Intgratd Leak Rate Test	-	28	1	1	51	-	-	15	95	95	-	-	471	-	-	-	-	-	737	-
2b.1.1.33	GR - Containment Atmospheric Control	-	15	2	1	95	13	-	22	147	147	-	-	882	29	-	-	-	2,592	391	-
2b.1.1.34	GT - Containment Purge HVAC	-	120	4	2	170	54	-	70	420	420	-	-	1,582	120	-	-	-	10,780	2,926	-
2b.1.1.35	HA - Gaseous Radwaste	-	249	12	5	243	213	-	154	875	875	-	-	2,259	486	-	-	-	42,123	6,498	-
2b.1.1.36	HB - Liquid Radwaste	582	617	40	13	485	877	-	743	3,357	3,357	-	-	4,516	2,205	-	-	-	173,674	29,832	-
2b.1.1.37	HC - Solid Radwaste	-	331	25	8	243	664	-	289	1,559	1,559	-	-	2,259	1,514	-	-	-	131,446	8,765	-
2b.1.1.38	HD - Decontamination	-	76	3	1	86	55	-	46	267	267	-	-	799	125	-	-	-	10,842	1,982	-
2b.1.1.39	JE - Emergency Fuel Oil	-	45	-	-	-	-	-	7	52	-	-	52	-	-	-	-	-	-	1,260	-
2b.1.1.40	KA - Compressed Air	-	135	-	-	-	-	-	20	155	-	-	155	-	-	-	-	-	-	4,187	-
2b.1.1.41	KA - Compressed Air RCA	-	89	1	1	70	-	-	33	193	193	-	-	651	-	-	-	-	-	2,241	-
2b.1.1.42	KB - Breathing Air	-	17	-	-	-	-	-	2	19	-	-	19	-	-	-	-	-	-	516	-
2b.1.1.43	KB - Breathing Air RCA	-	13	0	0	6	-	-	4	24	24	-	-	57	-	-	-	-	-	376	-
2b.1.1.44	KC - Fire Protection	-	270	-	-	-	-	-	41	311	-	-	311	-	-	-	-	-	-	8,376	-
2b.1.1.45	KC - Fire Protection RCA	-	284	5	4	385	-	-	130	808	808	-	-	3,583	-	-	-	-	-	6,950	-
2b.1.1.46	KD - Domestic Water	-	125	-	-	-	-	-	19	144	-	-	144	-	-	-	-	-	-	3,837	-
2b.1.1.47	KD - Domestic Water RCA	-	18	0	0	22	-	-	8	48	48	-	-	201	-	-	-	-	-	448	-
2b.1.1.48	KE - Fuel Handling & Storage Rctor vssl	-	14	2	1	58	50	-	25	151	151	-	-	537	111	-	-	-	10,000	374	-
2b.1.1.49	KH - Service Gas (CO2 N2 H2 & O2)	-	40	-	-	-	-	-	6	46	-	-	46	-	-	-	-	-	-	1,226	-
2b.1.1.50	KH - Service Gas (CO2 N2 H2 & O2) RCA	-	178	3	2	212	-	-	77	472	472	-	-	1,976	-	-	-	-	-	4,377	-
2b.1.1.51	KJ - Standby Diesel Engine	-	239	-	-	-	-	-	36	275	-	-	275	-	-	-	-	-	-	6,749	-
2b.1.1.52	LA - Sanitary Drains	-	32	-	-	-	-	-	5	37	-	-	37	-	-	-	-	-	-	972	-
2b.1.1.53	LA - Sanitary Drains RCA	-	76	1	1	111	-	-	36	226	226	-	-	1,034	-	-	-	-	-	1,810	-
2b.1.1.54	LB - Roof Drains	-	42	-	-	-	-	-	6	49	-	-	49	-	-	-	-	-	-	1,276	-
2b.1.1.55	LB - Roof Drains RCA	-	102	2	2	187	-	-	54	347	347	-	-	1,737	-	-	-	-	-	2,627	-
2b.1.1.56	LD - Chemical & Detergent Waste	48	79	3	1	44	67	-	68	311	311	-	-	409	150	-	-	-	13,339	3,233	-
2b.1.1.57	LF - Floor & Equipment Drains	-	1,021	57	19	326	1,830	-	770	4,025	4,025	-	-	3,037	4,073	-	-	-	362,460	27,093	-

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2002 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
Disposal of Plant Systems (continued)																					
2b.1.1.58	RM - Process Sampling & Analysis	-	102	4	1	58	77	-	54	296	296	-	-	537	169	-	-	-	15,160	2,724	-
2b.1.1.59	SJ - Nuclear Sampling	-	57	3	1	37	59	-	35	192	192	-	-	344	130	-	-	-	11,668	1,538	-
2b.1.1.60	UB - Servces Stores Site Security Bldg	-	122	-	-	-	-	-	18	140	-	-	140	-	-	-	-	-	-	3,571	-
2b.1.1.61	Yard Non-System Specific	-	22	-	-	-	-	-	3	25	-	-	25	-	-	-	-	-	-	603	-
2b.1.1	Totals	1,154	11,539	334	157	8,631	6,874	-	6,171	34,860	30,715	-	4,145	80,284	15,939	-	-	-	1,361,135	333,795	-
2b.1.2	Scaffolding in support of decommissioning	-	1,251	19	2	149	27	-	344	1,793	1,793	-	-	1,387	96	-	-	-	8,607	38,222	-
Decontamination of Site Buildings																					
2b.1.3.1	Reactor	931	761	103	58	520	1,096	-	1,027	4,496	4,496	-	-	4,837	7,670	-	-	-	724,445	43,233	-
2b.1.3.2	Auxiliary	482	279	45	27	180	71	-	364	1,447	1,447	-	-	1,672	3,322	-	-	-	328,482	19,320	-
2b.1.3.3	Communication Corridor - Contaminated	11	5	1	1	1	1	-	7	27	27	-	-	13	72	-	-	-	7,180	395	-
2b.1.3.4	Hot Machine Shop	13	6	1	1	-	2	-	9	31	31	-	-	-	89	-	-	-	8,892	481	-
2b.1.3.5	RAM Storage Building	33	13	2	1	2	3	-	21	76	76	-	-	15	185	-	-	-	18,376	1,167	-
2b.1.3.6	Radioactive and Personnel Tunnel	4	7	1	0	-	1	-	4	18	18	-	-	-	50	-	-	-	5,022	275	-
2b.1.3.7	Radwaste	257	136	24	14	74	36	-	187	726	726	-	-	686	1,756	-	-	-	174,315	9,956	-
2b.1.3.8	Radwaste Drum Storage	29	14	3	2	6	4	-	20	77	77	-	-	54	196	-	-	-	19,544	1,090	-
2b.1.3	Totals	1,760	1,221	180	103	782	1,213	-	1,639	6,898	6,898	-	-	7,277	13,340	-	-	-	1,286,256	75,916	-
2b.1	Subtotal Period 2b Activity Costs	2,914	14,011	533	263	9,562	8,114	-	8,155	43,551	39,406	-	4,145	88,949	29,374	-	-	-	2,655,998	447,933	-
Period 2b Additional Costs																					
2b.2.1	Curie Surcharge (Excluding RPV)	-	-	-	-	-	832	-	208	1,039	-	-	1,039	-	-	-	-	-	-	-	-
2b.2	Subtotal Period 2b Additional Costs	-	-	-	-	-	832	-	208	1,039	-	-	1,039	-	-	-	-	-	-	-	-
Period 2b Collateral Costs																					
2b.3.1	Process liquid waste	153	-	154	293	-	1,907	-	613	3,120	3,120	-	-	-	-	2,518	-	-	377,527	251	-
2b.3.2	Small tool allowance	-	249	-	-	-	-	-	37	286	286	-	-	-	-	-	-	-	-	-	-
2b.3	Subtotal Period 2b Collateral Costs	153	249	154	293	-	1,907	-	650	3,406	3,406	-	-	-	-	2,518	-	-	377,527	251	-
Period 2b Period-Dependent Costs																					
2b.4.1	Decon supplies	825	-	-	-	-	-	-	206	1,032	1,032	-	-	-	-	-	-	-	-	-	-
2b.4.2	Insurance	-	-	-	-	-	-	1,132	113	1,246	1,246	-	-	-	-	-	-	-	-	-	-
2b.4.3	Property taxes	-	-	-	-	-	-	683	68	751	751	-	-	-	-	-	-	-	-	-	-
2b.4.4	Health physics supplies	-	1,827	-	-	-	-	-	457	2,284	2,284	-	-	-	-	-	-	-	-	-	-
2b.4.5	Heavy equipment rental	-	4,144	-	-	-	-	-	622	4,766	4,766	-	-	-	-	-	-	-	-	-	-
2b.4.6	Disposal of DAW generated	-	-	99	20	-	441	-	123	684	684	-	-	-	6,379	-	-	-	127,823	1,566	-
2b.4.7	Plant energy budget	-	-	-	-	-	-	1,947	292	2,239	2,239	-	-	-	-	-	-	-	-	-	-
2b.4.8	NRC Fees	-	-	-	-	-	-	785	79	864	864	-	-	-	-	-	-	-	-	-	-
2b.4.9	Emergency Planning Fees	-	-	-	-	-	-	251	25	276	-	276	-	-	-	-	-	-	-	-	-
2b.4.10	Transferal of spent fuel to DOE	-	-	-	-	-	-	7,400	740	8,140	-	8,140	-	-	-	-	-	-	-	-	-
2b.4.11	Spent Fuel Pool O&M	-	-	-	-	-	-	2,337	351	2,688	-	2,688	-	-	-	-	-	-	-	-	-
2b.4.12	Radwaste Processing Equipment/Services	-	-	-	-	-	-	447	67	514	514	-	-	-	-	-	-	-	-	-	-
2b.4.13	Security Staff Cost	-	-	-	-	-	-	3,684	553	4,237	4,237	-	-	-	-	-	-	-	-	-	146,416
2b.4.14	DOC Staff Cost	-	-	-	-	-	-	26,114	3,917	30,031	30,031	-	-	-	-	-	-	-	-	-	393,897
2b.4.15	Utility Staff Cost	-	-	-	-	-	-	29,828	4,474	34,302	34,302	-	-	-	-	-	-	-	-	-	555,861
2b.4	Subtotal Period 2b Period-Dependent Costs	825	5,972	99	20	-	441	74,608	12,087	94,052	82,949	11,103	-	-	6,379	-	-	-	127,823	1,566	1,096,174
2b.0	TOTAL PERIOD 2b COST	3,893	20,232	786	577	9,562	11,293	74,608	21,100	142,050	125,761	11,103	5,185	88,949	35,753	2,518	-	-	3,161,348	449,751	1,096,174
PERIOD 2c - Decontamination Following Wet Fuel Storage																					
Period 2c Direct Decommissioning Activities																					
2c.1.1	Remove spent fuel racks	607	63	178	13	724	209	-	500	2,294	2,294	-	-	6,737	740	-	-	-	66,393	1,925	-
Disposal of Plant Systems																					
2c.1.2.1	600 Fuel Bldg Non-Specific Systems RCA	-	224	4	3	279	-	-	99	610	610	-	-	2,599	-	-	-	-	-	5,858	-
2c.1.2.2	600 Fuel Bldg Non-System Specific	-	36	1	0	15	39	-	21	112	112	-	-	138	85	-	-	-	7,627	953	-
2c.1.2.3	EC - Fuel Pool Cooling & Cleanup	-	277	13	6	227	349	-	193	1,065	1,065	-	-	2,113	770	-	-	-	69,027	7,393	-
2c.1.2.4	GA- Plant Heating Fuel Building	-	15	1	0	4	13	-	8	41	41	-	-	41	29	-	-	-	2,612	395	-
2c.1.2.5	GG - Fuel Building HVAC	-	279	6	4	326	50	-	132	796	796	-	-	3,028	109	-	-	-	9,816	6,635	-
2c.1.2.6	KC- Fire Protection Fuel Building	-	84	1	1	108	-	-	38	233	233	-	-	1,007	-	-	-	-	-	2,083	-
2c.1.2	Totals	-	915	26	15	960	450	-	490	2,855	2,855	-	-	8,927	994	-	-	-	89,083	23,317	-
Decontamination of Site Buildings																					
2c.1.3.1	Fuel Building	610	641	15	9	236	35	-	512	2,058	2,058	-	-	2,197	909	-	-	-	89,694	31,188	-
2c.1.3	Totals	610	641	15	9	236	35	-	512	2,058	2,058	-	-	2,197	909	-	-	-	89,694	31,188	-
2c.1.4	Scaffolding in support of decommissioning	-	250	4	0	30	5	-	69	359	359	-	-	277	19	-	-	-	1,721	7,644	-

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2002 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Burial Volumes Class B Cu. Feet	Burial Volumes Class C Cu. Feet	Burial Volumes GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
2c.1	Subtotal Period 2c Activity Costs	1,217	1,869	223	37	1,950	699	-	1,571	7,566	7,566	-	-	18,138	2,662	-	-	-	246,892	64,074	-
Period 2c Collateral Costs																					
2c.3.1	Process liquid waste	83	-	27	86	-	383	-	153	732	732	-	-	-	-	601	-	-	75,796	118	-
2c.3.2	Small tool allowance	-	47	-	-	-	-	-	7	54	54	-	-	-	-	-	-	-	-	-	-
2c.3.3	Decommissioning Equipment Disposition	-	-	75	10	581	106	-	122	894	894	-	-	5,400	373	-	-	-	33,507	739	-
2c.3	Subtotal Period 2c Collateral Costs	83	47	102	97	581	488	-	282	1,679	1,679	-	-	5,400	373	601	-	-	109,302	858	-
Period 2c Period-Dependent Costs																					
2c.4.1	Decon supplies	119	-	-	-	-	-	-	30	149	149	-	-	-	-	-	-	-	-	-	-
2c.4.2	Insurance	-	-	-	-	-	-	270	27	297	297	-	-	-	-	-	-	-	-	-	-
2c.4.3	Property taxes	-	-	-	-	-	-	183	18	201	201	-	-	-	-	-	-	-	-	-	-
2c.4.4	Health physics supplies	-	330	-	-	-	-	-	82	412	412	-	-	-	-	-	-	-	-	-	-
2c.4.5	Heavy equipment rental	-	1,110	-	-	-	-	-	167	1,277	1,277	-	-	-	-	-	-	-	-	-	-
2c.4.6	Disposal of DAW generated	-	-	32	7	-	141	-	39	218	218	-	-	-	2,036	-	-	-	40,807	500	-
2c.4.7	Plant energy budget	-	-	-	-	-	-	422	63	485	485	-	-	-	-	-	-	-	-	-	-
2c.4.8	NRC Fees	-	-	-	-	-	-	302	30	332	332	-	-	-	-	-	-	-	-	-	-
2c.4.9	Radwaste Processing Equipment/Services	-	-	-	-	-	-	240	36	275	275	-	-	-	-	-	-	-	-	-	-
2c.4.10	Security Staff Cost	-	-	-	-	-	-	987	148	1,135	1,135	-	-	-	-	-	-	-	-	-	39,227
2c.4.11	DOC Staff Cost	-	-	-	-	-	-	6,996	1,049	8,046	8,046	-	-	-	-	-	-	-	-	-	105,531
2c.4.12	Utility Staff Cost	-	-	-	-	-	-	7,991	1,199	9,190	9,190	-	-	-	-	-	-	-	-	-	148,924
2c.4	Subtotal Period 2c Period-Dependent Costs	119	1,440	32	7	-	141	17,391	2,889	22,018	22,018	-	-	-	2,036	-	-	-	40,807	500	293,683
2c.0	TOTAL PERIOD 2c COST	1,419	3,356	356	141	2,530	1,328	17,391	4,742	31,263	31,263	-	-	23,538	5,072	601	-	-	397,001	65,432	293,683
PERIOD 2e - License Termination																					
Period 2e Direct Decommissioning Activities																					
2e.1.1	ORISE confirmatory survey	-	-	-	-	-	-	120	36	156	156	-	-	-	-	-	-	-	-	-	-
2e.1.2	Terminate license									a											
2e.1	Subtotal Period 2e Activity Costs	-	-	-	-	-	-	120	36	156	156	-	-	-	-	-	-	-	-	-	-
Period 2e Additional Costs																					
2e.2.1	Final Site Survey	-	-	-	-	-	-	5,999	1,800	7,799	7,799	-	-	-	-	-	-	-	-	146,136	-
2e.2	Subtotal Period 2e Additional Costs	-	-	-	-	-	-	5,999	1,800	7,799	7,799	-	-	-	-	-	-	-	-	146,136	-
Period 2e Collateral Costs																					
2e.3.1	DOC staff relocation expenses	-	-	-	-	-	-	753	113	866	866	-	-	-	-	-	-	-	-	-	-
2e.3	Subtotal Period 2e Collateral Costs	-	-	-	-	-	-	753	113	866	866	-	-	-	-	-	-	-	-	-	-
Period 2e Period-Dependent Costs																					
2e.4.1	Insurance	-	-	-	-	-	-	232	23	255	255	-	-	-	-	-	-	-	-	-	-
2e.4.2	Property taxes	-	-	-	-	-	-	212	21	233	233	-	-	-	-	-	-	-	-	-	-
2e.4.3	Health physics supplies	-	587	-	-	-	-	-	147	734	734	-	-	-	-	-	-	-	-	-	-
2e.4.4	Disposal of DAW generated	-	-	5	1	-	22	-	6	33	33	-	-	-	311	-	-	-	6,238	76	-
2e.4.5	Plant energy budget	-	-	-	-	-	-	437	66	502	502	-	-	-	-	-	-	-	-	-	-
2e.4.6	NRC Fees	-	-	-	-	-	-	329	33	362	362	-	-	-	-	-	-	-	-	-	-
2e.4.7	Security Staff Cost	-	-	-	-	-	-	364	55	418	418	-	-	-	-	-	-	-	-	-	14,451
2e.4.8	DOC Staff Cost	-	-	-	-	-	-	5,646	847	6,493	6,493	-	-	-	-	-	-	-	-	-	81,891
2e.4.9	Utility Staff Cost	-	-	-	-	-	-	5,074	761	5,835	5,835	-	-	-	-	-	-	-	-	-	85,504
2e.4	Subtotal Period 2e Period-Dependent Costs	-	587	5	1	-	22	12,293	1,958	14,866	14,866	-	-	-	311	-	-	-	6,238	76	181,847
2e.0	TOTAL PERIOD 2e COST	-	587	5	1	-	22	19,165	3,907	23,687	23,687	-	-	-	311	-	-	-	6,238	146,212	181,847
PERIOD 2 TOTALS		7,204	46,011	9,210	3,265	19,485	62,727	158,291	63,180	369,372	342,707	17,970	8,694	176,202	90,445	7,352	861	652	9,629,382	991,280	2,277,294
PERIOD 3b - Site Restoration																					
Period 3b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
3b.1.1.1	Reactor	-	4,414	-	-	-	-	-	662	5,076	-	-	5,076	-	-	-	-	-	-	73,822	-
3b.1.1.2	Auxiliary	-	3,157	-	-	-	-	-	474	3,630	-	-	3,630	-	-	-	-	-	-	59,349	-
3b.1.1.3	Auxiliary Boiler	-	27	-	-	-	-	-	4	31	-	-	31	-	-	-	-	-	-	587	-
3b.1.1.4	Circulating & Service Water Pumphouse	-	202	-	-	-	-	-	30	233	-	-	233	-	-	-	-	-	-	4,138	-
3b.1.1.5	Communication Corridor - Clean	-	1,025	-	-	-	-	-	154	1,179	-	-	1,179	-	-	-	-	-	-	20,542	-
3b.1.1.6	Communication Corridor - Contaminated	-	39	-	-	-	-	-	6	45	-	-	45	-	-	-	-	-	-	666	-
3b.1.1.7	Cooling Tower	-	1,017	-	-	-	-	-	153	1,170	-	-	1,170	-	-	-	-	-	-	17,975	-
3b.1.1.8	Diesel Generator	-	364	-	-	-	-	-	55	419	-	-	419	-	-	-	-	-	-	6,119	-
3b.1.1.9	Essential Service Water Pumphouse	-	123	-	-	-	-	-	18	142	-	-	142	-	-	-	-	-	-	2,766	-

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Callaway Plant
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Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
3b.1.1.10	Fire Water Pumphouse	-	22	-	-	-	-	-	3	26	-	-	26	-	-	-	-	-	-	375	-
3b.1.1.11	Hot Machine Shop	-	21	-	-	-	-	-	3	25	-	-	25	-	-	-	-	-	-	464	-
3b.1.1.12	Intake	-	262	-	-	-	-	-	39	301	-	-	301	-	-	-	-	-	-	4,166	-
3b.1.1.13	Misc. Structures	-	1,785	-	-	-	-	-	268	2,052	-	-	2,052	-	-	-	-	-	-	28,096	-
3b.1.1.14	Miscellaneous Site Foundations	-	318	-	-	-	-	-	48	366	-	-	366	-	-	-	-	-	-	5,368	-
3b.1.1.15	Outage Maintenance	-	149	-	-	-	-	-	22	172	-	-	172	-	-	-	-	-	-	3,222	-
3b.1.1.16	RAM Storage Building	-	37	-	-	-	-	-	6	42	-	-	42	-	-	-	-	-	-	920	-
3b.1.1.17	Radioactive and Personnel Tunnel	-	26	-	-	-	-	-	4	30	-	-	30	-	-	-	-	-	-	652	-
3b.1.1.18	Radwaste	-	1,337	-	-	-	-	-	201	1,538	-	-	1,538	-	-	-	-	-	-	24,007	-
3b.1.1.19	Radwaste Drum Storage	-	216	-	-	-	-	-	32	249	-	-	249	-	-	-	-	-	-	3,857	-
3b.1.1.20	Service	-	340	-	-	-	-	-	51	391	-	-	391	-	-	-	-	-	-	5,611	-
3b.1.1.21	Sludge Pump Station & Lagoon	-	17	-	-	-	-	-	3	20	-	-	20	-	-	-	-	-	-	316	-
3b.1.1.22	Turbine Building	-	3,796	-	-	-	-	-	569	4,365	-	-	4,365	-	-	-	-	-	-	87,807	-
3b.1.1.23	Turbine Pedestal	-	752	-	-	-	-	-	113	865	-	-	865	-	-	-	-	-	-	10,928	-
3b.1.1.24	U.H.S. Cooling Tower	-	451	-	-	-	-	-	68	518	-	-	518	-	-	-	-	-	-	6,615	-
3b.1.1.25	Water Treatment Plant	-	0	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	-	8	-
3b.1.1.26	Fuel Building	-	1,679	-	-	-	-	-	252	1,931	-	-	1,931	-	-	-	-	-	-	27,061	-
3b.1.1	Totals	-	21,577	-	-	-	-	-	3,237	24,813	-	-	24,813	-	-	-	-	-	-	395,436	-
Site Closeout Activities																					
3b.1.2	BackFill Site	-	3,165	-	-	-	-	-	475	3,640	-	-	3,640	-	-	-	-	-	-	17,176	-
3b.1.3	Grade & landscape site	-	1,478	-	-	-	-	-	222	1,699	-	-	1,699	-	-	-	-	-	-	5,839	-
3b.1.4	Final report to NRC	-	-	-	-	-	-	114	17	132	132	-	-	-	-	-	-	-	-	-	1,560
3b.1	Subtotal Period 3b Activity Costs	-	26,220	-	-	-	-	114	3,950	30,284	132	-	30,153	-	-	-	-	-	-	418,450	1,560
Period 3b Additional Costs																					
3b.2.1	Concrete Crushing	-	555	-	-	-	-	131	103	789	-	-	789	-	-	-	-	-	-	4,145	-
3b.2	Subtotal Period 3b Additional Costs	-	555	-	-	-	-	131	103	789	-	-	789	-	-	-	-	-	-	4,145	-
Period 3b Collateral Costs																					
3b.3.1	Small tool allowance	-	237	-	-	-	-	-	36	272	-	-	272	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	-	237	-	-	-	-	-	36	272	-	-	272	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																					
3b.4.1	Insurance	-	-	-	-	-	-	454	45	499	-	-	499	-	-	-	-	-	-	-	-
3b.4.2	Property taxes	-	-	-	-	-	-	414	41	456	-	-	456	-	-	-	-	-	-	-	-
3b.4.3	Heavy equipment rental	-	3,402	-	-	-	-	-	510	3,913	-	-	3,913	-	-	-	-	-	-	-	-
3b.4.4	Plant energy budget	-	-	-	-	-	-	50	8	58	-	-	58	-	-	-	-	-	-	-	-
3b.4.5	Security Staff Cost	-	-	-	-	-	-	712	107	819	-	-	819	-	-	-	-	-	-	-	28,286
3b.4.6	DOC Staff Cost	-	-	-	-	-	-	8,614	1,292	9,906	-	-	9,906	-	-	-	-	-	-	-	122,571
3b.4.7	Utility Staff Cost	-	-	-	-	-	-	3,696	554	4,250	-	-	4,250	-	-	-	-	-	-	-	58,143
3b.4	Subtotal Period 3b Period-Dependent Costs	-	3,402	-	-	-	-	13,939	2,558	19,900	-	-	19,900	-	-	-	-	-	-	-	209,000
3b.0	TOTAL PERIOD 3b COST	-	30,414	-	-	-	-	14,185	6,646	51,245	132	-	51,113	-	-	-	-	-	-	422,595	210,560
PERIOD 3 TOTALS		-	30,414	-	-	-	-	14,185	6,646	51,245	132	-	51,113	-	-	-	-	-	-	422,595	210,560
TOTAL COST TO DECOMMISSION		8,753	78,103	9,605	3,799	19,485	67,269	245,592	82,733	515,339	430,019	24,604	60,715	176,202	91,070	12,733	861	652	10,532,770	1,415,292	3,413,754

TOTAL COST TO DECOMMISSION WITH 19.12% CONTINGENCY:	**$515,339**	**thousands of 2002 dollars**
TOTAL NRC LICENSE TERMINATION COST IS 83.44% OR	**$430,019**	**thousands of 2002 dollars**
SPENT FUEL MANAGEMENT COST IS 4.77% OR:	**$24,604**	**thousands of 2002 dollars**
NON-NUCLEAR DEMOLITION COST IS 11.78% OR:	**$60,715**	**thousands of 2002 dollars**
TOTAL PRIMARY SITE RADWASTE VOLUME BURIED:	**73,397**	**cubic feet**
TOTAL SECONDARY SITE RADWASTE VOLUME BURIED:	**20,910**	**cubic feet**
TOTAL TERTIARY SITE RADWASTE VOLUME BURIED:	**10,358**	**cubic feet**
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:	**652**	**cubic feet**
TOTAL SCRAP METAL REMOVED:	**76,118**	**tons**

Table C
Callaway Plant
DECON Decommissioning Cost Estimate
(Thousands of 2002 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
TOTAL CRAFT LABOR REQUIREMENTS:				1,415,292	man-hours																

End Notes:
n/a - indicates that this activity not charged as decommissioning expense.
a - indicates that this activity performed by decommissioning staff.
0 - indicates that this value is less than 0.5 but is non-zero.
a cell containing " - " indicates a zero value

APPENDIX D

SAFSTOR DECOMMISSIONING COST ESTIMATE

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2002 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
PERIOD 1a - Shutdown through Transition																					
Period 1a Direct Decommissioning Activities																					
1a.1.1	SAFSTOR site characterization survey	-	-	-	-	-	-	340	102	442	442	-	-	-	-	-	-	-	-	-	-
1a.1.2	Prepare preliminary decommissioning cost	-	-	-	-	-	-	95	14	110	110	-	-	-	-	-	-	-	-	-	1,300
1a.1.3	Notification of Cessation of Operations									a											
1a.1.4	Remove fuel & source material									n/a											
1a.1.5	Notification of Permanent Defueling									a											
1a.1.6	Deactivate plant systems & process waste									a											
1a.1.7	Prepare and submit PSDAR	-	-	-	-	-	-	147	22	169	169	-	-	-	-	-	-	-	-	-	2,000
1a.1.8	Review plant dwgs & specs.	-	-	-	-	-	-	95	14	110	110	-	-	-	-	-	-	-	-	-	1,300
1a.1.9	Perform detailed rad survey									a											
1a.1.10	Estimate by-product inventory	-	-	-	-	-	-	73	11	84	84	-	-	-	-	-	-	-	-	-	1,000
1a.1.11	End product description	-	-	-	-	-	-	73	11	84	84	-	-	-	-	-	-	-	-	-	1,000
1a.1.12	Detailed by-product inventory	-	-	-	-	-	-	110	16	126	126	-	-	-	-	-	-	-	-	-	1,500
1a.1.13	Define major work sequence	-	-	-	-	-	-	73	11	84	84	-	-	-	-	-	-	-	-	-	1,000
1a.1.14	Perform SER and EA	-	-	-	-	-	-	227	34	261	261	-	-	-	-	-	-	-	-	-	3,100
1a.1.15	Perform Site-Specific Cost Study	-	-	-	-	-	-	367	55	422	422	-	-	-	-	-	-	-	-	-	5,000
Activity Specifications																					
1a.1.16.1	Prepare plant and facilities for SAFSTOR	-	-	-	-	-	-	361	54	415	415	-	-	-	-	-	-	-	-	-	4,920
1a.1.16.2	Plant systems	-	-	-	-	-	-	306	46	351	351	-	-	-	-	-	-	-	-	-	4,167
1a.1.16.3	Plant structures and buildings	-	-	-	-	-	-	229	34	263	263	-	-	-	-	-	-	-	-	-	3,120
1a.1.16.4	Waste management	-	-	-	-	-	-	147	22	169	169	-	-	-	-	-	-	-	-	-	2,000
1a.1.16.5	Facility and site dormancy	-	-	-	-	-	-	147	22	169	169	-	-	-	-	-	-	-	-	-	2,000
1a.1.16	Total	-	-	-	-	-	-	1,188	178	1,367	1,367	-	-	-	-	-	-	-	-	-	16,207
Detailed Work Procedures																					
1a.1.17.1	Plant systems	-	-	-	-	-	-	87	13	100	100	-	-	-	-	-	-	-	-	-	1,183
1a.1.17.2	Facility closeout & dormancy	-	-	-	-	-	-	88	13	101	101	-	-	-	-	-	-	-	-	-	1,200
1a.1.17	Total	-	-	-	-	-	-	175	26	201	201	-	-	-	-	-	-	-	-	-	2,383
1a.1.18	Procure vacuum drying system	-	-	-	-	-	-	7	1	8	8	-	-	-	-	-	-	-	-	-	100
1a.1.19	Drain/de-energize non-cont. systems									a											
1a.1.20	Drain & dry NSSS									a											
1a.1.21	Drain/de-energize contaminated systems									a											
1a.1.22	Decon/secure contaminated systems									a											
1a.1	Subtotal Period 1a Activity Costs	-	-	-	-	-	-	2,972	497	3,469	3,469	-	-	-	-	-	-	-	-	-	35,890
Period 1a Period-Dependent Costs																					
1a.4.1	Insurance	-	-	-	-	-	-	1,378	138	1,516	1,516	-	-	-	-	-	-	-	-	-	-
1a.4.2	Property taxes	-	-	-	-	-	-	275	27	302	302	-	-	-	-	-	-	-	-	-	-
1a.4.3	Health physics supplies	-	212	-	-	-	-	-	53	265	265	-	-	-	-	-	-	-	-	-	-
1a.4.4	Heavy equipment rental	-	296	-	-	-	-	-	44	340	340	-	-	-	-	-	-	-	-	-	-
1a.4.5	Disposal of DAW generated	-	-	6	1	-	28	-	8	43	43	-	-	-	404	-	-	-	8,103	99	-
1a.4.6	Plant energy budget	-	-	-	-	-	-	871	131	1,001	1,001	-	-	-	-	-	-	-	-	-	-
1a.4.7	NRC Fees	-	-	-	-	-	-	328	33	361	361	-	-	-	-	-	-	-	-	-	-
1a.4.8	Emergency Planning Fees	-	-	-	-	-	-	101	10	111	-	111	-	-	-	-	-	-	-	-	-
1a.4.9	Spent Fuel Pool O&M	-	-	-	-	-	-	940	141	1,082	-	1,082	-	-	-	-	-	-	-	-	-
1a.4.10	Security Staff Cost	-	-	-	-	-	-	1,483	222	1,705	1,705	-	-	-	-	-	-	-	-	-	58,921
1a.4.11	Utility Staff Cost	-	-	-	-	-	-	22,360	3,354	25,714	25,714	-	-	-	-	-	-	-	-	-	440,086
1a.4	Subtotal Period 1a Period-Dependent Costs	-	507	6	1	-	28	27,736	4,161	32,441	31,248	1,193	-	-	404	-	-	-	8,103	99	499,007
1a.0	TOTAL PERIOD 1a COST	-	507	6	1	-	28	30,708	4,658	35,910	34,717	1,193	-	-	404	-	-	-	8,103	99	534,897
PERIOD 1b - SAFSTOR Limited DECON Activities																					
Period 1b Direct Decommissioning Activities																					
Decontamination of Site Buildings																					
1b.1.1.1	Reactor	828	-	-	-	-	-	-	414	1,242	1,242	-	-	-	-	-	-	-	-	21,564	-
1b.1.1.2	Auxiliary	411	-	-	-	-	-	-	205	616	616	-	-	-	-	-	-	-	-	11,200	-
1b.1.1.3	Communication Corridor - Contaminated	9	-	-	-	-	-	-	5	14	14	-	-	-	-	-	-	-	-	247	-
1b.1.1.4	Fuel Building	541	-	-	-	-	-	-	270	811	811	-	-	-	-	-	-	-	-	12,877	-
1b.1.1.5	Hot Machine Shop	11	-	-	-	-	-	-	6	17	17	-	-	-	-	-	-	-	-	308	-
1b.1.1.6	RAM Storage Building	28	-	-	-	-	-	-	14	43	43	-	-	-	-	-	-	-	-	774	-

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2002 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
1b.1.1.7	Radioactive and Personnel Tunnel	3	-	-	-	-	-	-	2	5	5	-	-	-	-	-	-	-	-	91	-
1b.1.1.8	Radwaste	219	-	-	-	-	-	-	109	328	328	-	-	-	-	-	-	-	-	5,964	-
1b.1.1.9	Radwaste Drum Storage	25	-	-	-	-	-	-	12	37	37	-	-	-	-	-	-	-	-	671	-
1b.1.1	Totals	2,075	-	-	-	-	-	-	1,037	3,112	3,112	-	-	-	-	-	-	-	-	53,695	-
1b.1	Subtotal Period 1b Activity Costs	2,075	-	-	-	-	-	-	1,037	3,112	3,112	-	-	-	-	-	-	-	-	53,695	-
Period 1b Collateral Costs																					
1b.3.1	Decon equipment	603	-	-	-	-	-	-	90	693	693	-	-	-	-	-	-	-	-	-	-
1b.3.2	Process liquid waste	218	-	67	216	-	955	-	387	1,843	1,843	-	-	-	-	1,500	-	-	189,037	295	-
1b.3.3	Small tool allowance	-	31	-	-	-	-	-	5	36	36	-	-	-	-	-	-	-	-	-	-
1b.3	Subtotal Period 1b Collateral Costs	821	31	67	216	-	955	-	482	2,572	2,572	-	-	-	-	1,500	-	-	189,037	295	-
Period 1b Period-Dependent Costs																					
1b.4.1	Decon supplies	767	-	-	-	-	-	-	192	958	958	-	-	-	-	-	-	-	-	-	-
1b.4.2	Insurance	-	-	-	-	-	-	347	35	382	382	-	-	-	-	-	-	-	-	-	-
1b.4.3	Property taxes	-	-	-	-	-	-	69	7	76	76	-	-	-	-	-	-	-	-	-	-
1b.4.4	Health physics supplies	-	210	-	-	-	-	-	53	263	263	-	-	-	-	-	-	-	-	-	-
1b.4.5	Heavy equipment rental	-	74	-	-	-	-	-	11	86	86	-	-	-	-	-	-	-	-	-	-
1b.4.6	Disposal of DAW generated	-	-	11	2	-	47	-	13	73	73	-	-	-	685	-	-	-	13,730	168	-
1b.4.7	Plant energy budget	-	-	-	-	-	-	219	33	252	252	-	-	-	-	-	-	-	-	-	-
1b.4.8	NRC Fees	-	-	-	-	-	-	98	10	108	108	-	-	-	-	-	-	-	-	-	-
1b.4.9	Emergency Planning Fees	-	-	-	-	-	-	25	3	28	-	28	-	-	-	-	-	-	-	-	-
1b.4.10	Transferal of spent fuel to DOE	-	-	-	-	-	-	1,000	100	1,100	-	1,100	-	-	-	-	-	-	-	-	-
1b.4.11	Spent Fuel Pool O&M	-	-	-	-	-	-	237	36	273	-	273	-	-	-	-	-	-	-	-	-
1b.4.12	Security Staff Cost	-	-	-	-	-	-	374	56	430	430	-	-	-	-	-	-	-	-	-	14,851
1b.4.13	Utility Staff Cost	-	-	-	-	-	-	5,636	845	6,481	6,481	-	-	-	-	-	-	-	-	-	110,926
1b.4	Subtotal Period 1b Period-Dependent Costs	767	285	11	2	-	47	8,007	1,393	10,511	9,110	1,401	-	-	685	-	-	-	13,730	168	125,777
1b.0	TOTAL PERIOD 1b COST	3,662	316	78	218	-	1,002	8,007	2,912	16,194	14,794	1,401	-	-	685	1,500	-	-	202,766	54,158	125,777
PERIOD 1c - Preparations for SAFSTOR Dormancy																					
Period 1c Direct Decommissioning Activities																					
1c.1.1	Prepare support equipment for storage	-	369	-	-	-	-	-	55	425	425	-	-	-	-	-	-	-	-	3,000	-
1c.1.2	Install containment pressure equal. lines	-	30	-	-	-	-	-	5	35	35	-	-	-	-	-	-	-	-	700	-
1c.1.3	Interim survey prior to dormancy	-	-	-	-	-	-	783	110	893	893	-	-	-	-	-	-	-	-	16,005	-
1c.1.4	Secure building accesses									a											
1c.1.5	Prepare & submit interim report	-	-	-	-	-	-	43	-	43	43	-	-	-	-	-	-	-	-	-	583
1c.1	Subtotal Period 1c Activity Costs	-	400	-	-	-	-	826	170	1,395	1,395	-	-	-	-	-	-	-	-	19,705	583
Period 1c Additional Costs																					
1c.2.1	Spent Fuel Pool Isolation	-	-	-	-	-	-	7,879	1,182	9,060	9,060	-	-	-	-	-	-	-	-	-	-
1c.2	Subtotal Period 1c Additional Costs	-	-	-	-	-	-	7,879	1,182	9,060	9,060	-	-	-	-	-	-	-	-	-	-
Period 1c Collateral Costs																					
1c.3.1	Process liquid waste	172	-	53	170	-	754	-	305	1,455	1,455	-	-	-	-	1,185	-	-	149,316	233	-
1c.3.2	Small tool allowance	-	3	-	-	-	-	-	0	3	3	-	-	-	-	-	-	-	-	-	-
1c.3	Subtotal Period 1c Collateral Costs	172	3	53	170	-	754	-	306	1,458	1,458	-	-	-	-	1,185	-	-	149,316	233	-
Period 1c Period-Dependent Costs																					
1c.4.1	Insurance	-	-	-	-	-	-	347	35	382	382	-	-	-	-	-	-	-	-	-	-
1c.4.2	Property taxes	-	-	-	-	-	-	69	7	76	76	-	-	-	-	-	-	-	-	-	-
1c.4.3	Health physics supplies	-	111	-	-	-	-	-	28	139	139	-	-	-	-	-	-	-	-	-	-
1c.4.4	Heavy equipment rental	-	74	-	-	-	-	-	11	86	86	-	-	-	-	-	-	-	-	-	-
1c.4.5	Disposal of DAW generated	-	-	2	0	-	7	-	2	11	11	-	-	-	102	-	-	-	2,042	25	-
1c.4.6	Plant energy budget	-	-	-	-	-	-	219	33	252	252	-	-	-	-	-	-	-	-	-	-
1c.4.7	NRC Fees	-	-	-	-	-	-	98	10	108	108	-	-	-	-	-	-	-	-	-	-
1c.4.8	Emergency Planning Fees	-	-	-	-	-	-	25	3	28	-	28	-	-	-	-	-	-	-	-	-
1c.4.9	Transferal of spent fuel to DOE	-	-	-	-	-	-	1,000	100	1,100	-	1,100	-	-	-	-	-	-	-	-	-
1c.4.10	Spent Fuel Pool O&M	-	-	-	-	-	-	237	36	273	-	273	-	-	-	-	-	-	-	-	-
1c.4.11	Security Staff Cost	-	-	-	-	-	-	374	56	430	430	-	-	-	-	-	-	-	-	-	14,851
1c.4.12	Utility Staff Cost	-	-	-	-	-	-	5,636	845	6,481	6,481	-	-	-	-	-	-	-	-	-	110,926
1c.4	Subtotal Period 1c Period-Dependent Costs	-	186	2	0	-	7	8,007	1,165	9,366	7,966	1,401	-	-	102	-	-	-	2,042	25	125,777
1c.0	TOTAL PERIOD 1c COST	172	588	55	171	-	761	16,711	2,822	21,279	19,879	1,401	-	-	102	1,185	-	-	151,359	19,963	126,360
PERIOD 1 TOTALS		3,834	1,411	139	390	-	1,791	55,425	10,392	73,383	69,389	3,994	-	-	1,191	2,684	-	-	362,228	74,221	787,035

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2002 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
PERIOD 2a - SAFSTOR Dormancy with Wet Spent Fuel Storage																					
Period2a Direct Decommissioning Activities																					
2a.1.1	Quarterly Inspection									a											
2a.1.2	Semi-annual environmental survey									a											
2a.1.3	Prepare reports									a											
2a.1.4	Disposal of contaminated solid waste	-	-	5	2	-	-	-	1	7	7	-	-	-	403	-	-	-	47,448	104	-
2a.1.5	Bituminous roof replacement	-	-	-	-	-	-	387	58	445	445	-	-	-	-	-	-	-	-	-	-
2a.1.6	Maintenance supplies	-	-	-	-	-	-	479	120	599	599	-	-	-	-	-	-	-	-	-	-
2a.1	Subtotal Period 2a Activity Costs	-	-	5	2	-	-	865	178	1,051	1,051	-	-	-	403	-	-	-	47,448	104	-
Period 2a Period-Dependent Costs																					
2a.4.1	Insurance	-	-	-	-	-	-	1,823	182	2,005	2,005	-	-	-	-	-	-	-	-	-	-
2a.4.2	Property taxes	-	-	-	-	-	-	1,099	110	1,209	1,209	-	-	-	-	-	-	-	-	-	-
2a.4.3	Health physics supplies	-	212	-	-	-	-	-	53	265	265	-	-	-	-	-	-	-	-	-	-
2a.4.4	Disposal of DAW generated	-	-	25	5	-	112	-	31	173	173	-	-	-	1,617	-	-	-	32,412	397	-
2a.4.5	Plant energy budget	-	-	-	-	-	-	1,211	182	1,392	1,392	-	-	-	-	-	-	-	-	-	-
2a.4.6	NRC Fees	-	-	-	-	-	-	1,094	109	1,204	1,204	-	-	-	-	-	-	-	-	-	-
2a.4.7	Emergency Planning Fees	-	-	-	-	-	-	404	40	444	-	444	-	-	-	-	-	-	-	-	-
2a.4.8	Transferal of spent fuel to DOE	-	-	-	-	-	-	14,400	1,440	15,840	-	15,840	-	-	-	-	-	-	-	-	-
2a.4.9	Spent Fuel Pool O&M	-	-	-	-	-	-	3,762	564	4,326	-	4,326	-	-	-	-	-	-	-	-	-
2a.4.10	Security Staff Cost	-	-	-	-	-	-	3,254	488	3,742	3,742	-	-	-	-	-	-	-	-	-	129,314
2a.4.11	Utility Staff Cost	-	-	-	-	-	-	16,008	2,401	18,409	18,409	-	-	-	-	-	-	-	-	-	327,457
2a.4	Subtotal Period 2a Period-Dependent Costs	-	212	25	5	-	112	43,055	5,602	49,011	28,401	20,610	-	-	1,617	-	-	-	32,412	397	456,771
2a.0	TOTAL PERIOD 2a COST	-	212	30	7	-	112	43,921	5,780	50,062	29,451	20,610	-	-	2,021	-	-	-	79,860	501	456,771
PERIOD 2c - SAFSTOR Dormancy without Spent Fuel Storage																					
Period2c Direct Decommissioning Activities																					
2c.1.1	Quarterly Inspection									a											
2c.1.2	Semi-annual environmental survey									a											
2c.1.3	Prepare reports									a											
2c.1.4	Disposal of contaminated solid waste	-	-	61	22	-	-	-	9	93	93	-	-	-	5,030	-	-	-	592,059	1,293	-
2c.1.5	Bituminous roof replacement	-	-	-	-	-	-	4,823	723	5,547	5,547	-	-	-	-	-	-	-	-	-	-
2c.1.6	Maintenance supplies	-	-	-	-	-	-	5,975	1,494	7,469	7,469	-	-	-	-	-	-	-	-	-	-
2c.1	Subtotal Period 2c Activity Costs	-	-	61	22	-	-	10,798	2,227	13,108	13,108	-	-	-	5,030	-	-	-	592,059	1,293	-
Period 2c Period-Dependent Costs																					
2c.4.1	Insurance	-	-	-	-	-	-	15,024	1,502	16,526	16,526	-	-	-	-	-	-	-	-	-	-
2c.4.2	Property taxes	-	-	-	-	-	-	13,717	1,372	15,088	15,088	-	-	-	-	-	-	-	-	-	-
2c.4.3	Health physics supplies	-	2,648	-	-	-	-	-	662	3,310	3,310	-	-	-	-	-	-	-	-	-	-
2c.4.4	Disposal of DAW generated	-	-	313	65	-	1,397	-	390	2,165	2,165	-	-	-	20,182	-	-	-	404,440	4,955	-
2c.4.5	Plant energy budget	-	-	-	-	-	-	2,667	400	3,067	3,067	-	-	-	-	-	-	-	-	-	-
2c.4.6	NRC Fees	-	-	-	-	-	-	13,299	1,330	14,629	14,629	-	-	-	-	-	-	-	-	-	-
2c.4.7	Security Staff Cost	-	-	-	-	-	-	13,753	2,063	15,816	15,816	-	-	-	-	-	-	-	-	-	546,540
2c.4.8	Utility Staff Cost	-	-	-	-	-	-	61,590	9,238	70,828	70,828	-	-	-	-	-	-	-	-	-	1,249,234
2c.4	Subtotal Period 2c Period-Dependent Costs	-	2,648	313	65	-	1,397	120,049	16,958	141,429	141,429	-	-	-	20,182	-	-	-	404,440	4,955	1,795,774
2c.0	TOTAL PERIOD 2c COST	-	2,648	375	87	-	1,397	130,848	19,184	154,538	154,538	-	-	-	25,212	-	-	-	996,499	6,248	1,795,774
PERIOD 2 TOTALS		-	2,860	405	93	-	1,509	174,768	24,964	204,599	183,989	20,610	-	-	27,233	-	-	-	1,076,358	6,749	2,252,546
PERIOD 3a - Reactivate Site Following SAFSTOR Dormancy																					
Period 3a Direct Decommissioning Activities																					
3a.1.1	Prepare preliminary decommissioning cost	-	-	-	-	-	-	95	14	110	110	-	-	-	-	-	-	-	-	-	1,300
3a.1.2	Review plant dwgs & specs.	-	-	-	-	-	-	337	51	388	388	-	-	-	-	-	-	-	-	-	4,600
3a.1.3	Perform detailed rad survey									a											
3a.1.4	End product description	-	-	-	-	-	-	73	11	84	84	-	-	-	-	-	-	-	-	-	1,000
3a.1.5	Detailed by-product inventory	-	-	-	-	-	-	95	14	110	110	-	-	-	-	-	-	-	-	-	1,300
3a.1.6	Define major work sequence	-	-	-	-	-	-	550	82	632	632	-	-	-	-	-	-	-	-	-	7,500
3a.1.7	Perform SER and EA	-	-	-	-	-	-	227	34	261	261	-	-	-	-	-	-	-	-	-	3,100
3a.1.8	Perform Site-Specific Cost Study	-	-	-	-	-	-	367	55	422	422	-	-	-	-	-	-	-	-	-	5,000
3a.1.9	Prepare/submit License Termination Plan	-	-	-	-	-	-	300	45	345	345	-	-	-	-	-	-	-	-	-	4,096
3a.1.10	Receive NRC approval of termination plan									a											

Activity Specifications

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2002 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
3a.1.11.1	Re-activate plant & temporary facilities	-	-	-	-	-	-	540	81	622	559	-	62	-	-	-	-	-	-	-	7,370
3a.1.11.2	Plant systems	-	-	-	-	-	-	306	46	351	316	-	35	-	-	-	-	-	-	-	4,167
3a.1.11.3	Reactor internals	-	-	-	-	-	-	521	78	599	599	-	-	-	-	-	-	-	-	-	7,100
3a.1.11.4	Reactor vessel	-	-	-	-	-	-	477	71	548	548	-	-	-	-	-	-	-	-	-	6,500
3a.1.11.5	Biological shield	-	-	-	-	-	-	37	5	42	42	-	-	-	-	-	-	-	-	-	500
3a.1.11.6	Steam generators	-	-	-	-	-	-	229	34	263	263	-	-	-	-	-	-	-	-	-	3,120
3a.1.11.7	Reinforced concrete	-	-	-	-	-	-	117	18	135	67	-	67	-	-	-	-	-	-	-	1,600
3a.1.11.8	Turbine & condenser	-	-	-	-	-	-	59	9	67	-	-	67	-	-	-	-	-	-	-	800
3a.1.11.9	Plant structures & buildings	-	-	-	-	-	-	229	34	263	132	-	132	-	-	-	-	-	-	-	3,120
3a.1.11.10	Waste management	-	-	-	-	-	-	337	51	388	388	-	-	-	-	-	-	-	-	-	4,600
3a.1.11.11	Facility & site closeout	-	-	-	-	-	-	66	10	76	38	-	38	-	-	-	-	-	-	-	900
3a.1.11	Total	-	-	-	-	-	-	2,917	438	3,354	2,953	-	402	-	-	-	-	-	-	-	39,777
Planning & Site Preparations																					
3a.1.12	Prepare dismantling sequence	-	-	-	-	-	-	176	26	202	202	-	-	-	-	-	-	-	-	-	2,400
3a.1.13	Plant prep. & temp. svces	-	-	-	-	-	-	2,304	346	2,650	2,650	-	-	-	-	-	-	-	-	-	-
3a.1.14	Design water clean-up system	-	-	-	-	-	-	103	15	118	118	-	-	-	-	-	-	-	-	-	1,400
3a.1.15	Rigging/Cont. Cntrl Envlps/tooling/etc.	-	-	-	-	-	-	1,950	293	2,243	2,243	-	-	-	-	-	-	-	-	-	-
3a.1.16	Procure casks/liners & containers	-	-	-	-	-	-	90	14	104	104	-	-	-	-	-	-	-	-	-	1,230
3a.1	Subtotal Period 3a Activity Costs	-	-	-	-	-	-	9,585	1,438	11,023	10,622	-	402	-	-	-	-	-	-	-	72,703
Period 3a Period-Dependent Costs																					
3a.4.1	Insurance	-	-	-	-	-	-	151	15	166	166	-	-	-	-	-	-	-	-	-	-
3a.4.2	Property taxes	-	-	-	-	-	-	138	14	152	152	-	-	-	-	-	-	-	-	-	-
Period 3a Period-Dependent Costs (continued)																					
3a.4.3	Health physics supplies	-	106	-	-	-	-	-	27	133	133	-	-	-	-	-	-	-	-	-	-
3a.4.4	Heavy equipment rental	-	148	-	-	-	-	-	22	170	170	-	-	-	-	-	-	-	-	-	-
3a.4.5	Disposal of DAW generated	-	-	3	1	-	14	-	4	22	22	-	-	-	203	-	-	-	4,063	50	-
3a.4.6	Plant energy budget	-	-	-	-	-	-	437	65	502	502	-	-	-	-	-	-	-	-	-	-
3a.4.7	NRC Fees	-	-	-	-	-	-	196	20	215	215	-	-	-	-	-	-	-	-	-	-
3a.4.8	Security Staff Cost	-	-	-	-	-	-	342	51	393	393	-	-	-	-	-	-	-	-	-	13,594
3a.4.9	Utility Staff Cost	-	-	-	-	-	-	6,807	1,021	7,828	7,828	-	-	-	-	-	-	-	-	-	129,930
3a.4	Subtotal Period 3a Period-Dependent Costs	-	254	3	1	-	14	8,070	1,239	9,581	9,581	-	-	-	203	-	-	-	4,063	50	143,524
3a.0	TOTAL PERIOD 3a COST	-	254	3	1	-	14	17,655	2,677	20,604	20,202	-	402	-	203	-	-	-	4,063	50	216,227
PERIOD 3b - Decommissioning Preparations																					
Period 3b Direct Decommissioning Activities																					
Detailed Work Procedures																					
3b.1.1.1	Plant systems	-	-	-	-	-	-	347	52	399	359	-	40	-	-	-	-	-	-	-	4,733
3b.1.1.2	Reactor internals	-	-	-	-	-	-	183	27	211	211	-	-	-	-	-	-	-	-	-	2,500
3b.1.1.3	Remaining buildings	-	-	-	-	-	-	99	15	114	28	-	85	-	-	-	-	-	-	-	1,350
3b.1.1.4	CRD cooling assembly	-	-	-	-	-	-	73	11	84	84	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.5	CRD housings & ICI tubes	-	-	-	-	-	-	73	11	84	84	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.6	Incore instrumentation	-	-	-	-	-	-	73	11	84	84	-	-	-	-	-	-	-	-	-	1,000
3b.1.1.7	Reactor vessel	-	-	-	-	-	-	266	40	306	306	-	-	-	-	-	-	-	-	-	3,630
3b.1.1.8	Facility closeout	-	-	-	-	-	-	88	13	101	51	-	51	-	-	-	-	-	-	-	1,200
3b.1.1.9	Missile shields	-	-	-	-	-	-	33	5	38	38	-	-	-	-	-	-	-	-	-	450
3b.1.1.10	Biological shield	-	-	-	-	-	-	88	13	101	101	-	-	-	-	-	-	-	-	-	1,200
3b.1.1.11	Steam generators	-	-	-	-	-	-	337	51	388	388	-	-	-	-	-	-	-	-	-	4,600
3b.1.1.12	Reinforced concrete	-	-	-	-	-	-	73	11	84	42	-	42	-	-	-	-	-	-	-	1,000
3b.1.1.13	Turbine & condensers	-	-	-	-	-	-	229	34	263	-	-	263	-	-	-	-	-	-	-	3,120
3b.1.1.14	Auxiliary building	-	-	-	-	-	-	200	30	230	207	-	23	-	-	-	-	-	-	-	2,730
3b.1.1.15	Reactor building	-	-	-	-	-	-	200	30	230	207	-	23	-	-	-	-	-	-	-	2,730
3b.1.1	Total	-	-	-	-	-	-	2,364	355	2,719	2,192	-	527	-	-	-	-	-	-	-	32,243
3b.1	Subtotal Period 3b Activity Costs	-	-	-	-	-	-	2,364	355	2,719	2,192	-	527	-	-	-	-	-	-	-	32,243
Period 3b Additional Costs																					
3b.2.1	Site Characterization	-	-	-	-	-	-	1,463	439	1,901	1,901	-	-	-	-	-	-	-	-	-	-
3b.2	Subtotal Period 3b Additional Costs	-	-	-	-	-	-	1,463	439	1,901	1,901	-	-	-	-	-	-	-	-	-	-
Period 3b Collateral Costs																					
3b.3.1	Decon equipment	603	-	-	-	-	-	-	90	693	693	-	-	-	-	-	-	-	-	-	-
3b.3.2	DOC staff relocation expenses	-	-	-	-	-	-	753	113	866	866	-	-	-	-	-	-	-	-	-	-

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2002 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
3b.3.3	Pipe cutting equipment	-	911	-	-	-	-	-	137	1,048	1,048	-	-	-	-	-	-	-	-	-	-
3b.3	Subtotal Period 3b Collateral Costs	603	911	-	-	-	-	753	340	2,607	2,607	-	-	-	-	-	-	-	-	-	-
Period 3b Period-Dependent Costs																					
3b.4.1	Decon supplies	37	-	-	-	-	-	-	9	46	46	-	-	-	-	-	-	-	-	-	-
3b.4.2	Insurance	-	-	-	-	-	-	406	41	447	447	-	-	-	-	-	-	-	-	-	-
3b.4.3	Property taxes	-	-	-	-	-	-	276	28	303	303	-	-	-	-	-	-	-	-	-	-
3b.4.4	Health physics supplies	-	212	-	-	-	-	-	53	266	266	-	-	-	-	-	-	-	-	-	-
3b.4.5	Heavy equipment rental	-	296	-	-	-	-	-	44	341	341	-	-	-	-	-	-	-	-	-	-
3b.4.6	Disposal of DAW generated	-	-	6	1	-	28	-	8	43	43	-	-	-	405	-	-	-	8,125	100	-
3b.4.7	Plant energy budget	-	-	-	-	-	-	873	131	1,004	1,004	-	-	-	-	-	-	-	-	-	-
3b.4.8	NRC Fees	-	-	-	-	-	-	329	33	362	362	-	-	-	-	-	-	-	-	-	-
3b.4.9	Security Staff Cost	-	-	-	-	-	-	684	103	787	787	-	-	-	-	-	-	-	-	-	27,189
Period 3b Period-Dependent Costs (continued)																					
3b.4.10	DOC Staff Cost	-	-	-	-	-	-	9,160	1,374	10,533	10,533	-	-	-	-	-	-	-	-	-	135,943
3b.4.11	Utility Staff Cost	-	-	-	-	-	-	13,921	2,088	16,009	16,009	-	-	-	-	-	-	-	-	-	266,134
3b.4	Subtotal Period 3b Period-Dependent Costs	37	509	6	1	-	28	25,648	3,911	30,141	30,141	-	-	-	405	-	-	-	8,125	100	429,266
3b.0	TOTAL PERIOD 3b COST	640	1,420	6	1	-	28	30,229	5,045	37,369	36,842	-	527	-	405	-	-	-	8,125	100	461,509
PERIOD 3 TOTALS		640	1,674	9	2	-	42	47,884	7,722	57,973	57,044	-	929	-	608	-	-	-	12,188	149	677,736
PERIOD 4a - Large Component Removal																					
Period 4a Direct Decommissioning Activities																					
Nuclear Steam Supply System Removal																					
4a.1.1.1	Reactor Coolant Piping	26	124	19	5	138	353	-	156	822	822	-	-	767	767	-	-	-	69,979	3,966	-
4a.1.1.2	Pressurizer Relief Tank	4	18	4	1	39	92	-	36	194	194	-	-	164	164	-	-	-	18,198	473	-
4a.1.1.3	Reactor Coolant Pumps & Motors	13	60	35	40	1,035	1,708	-	613	3,504	3,504	-	-	1,476	1,278	-	-	-	416,554	2,304	-
4a.1.1.4	Pressurizer	7	22	448	133	-	1,217	-	378	2,204	2,204	-	-	-	2,426	-	-	-	269,001	2,862	-
4a.1.1.5	Steam Generators	55	3,740	3,184	907	2,597	10,699	-	4,481	25,663	25,663	-	-	20,192	17,453	-	-	-	2,401,813	23,227	-
4a.1.1.6	CRDMs/ICIs/Service Structure Removal	22	74	103	7	60	272	-	118	656	656	-	-	753	2,947	-	-	-	53,766	2,382	-
4a.1.1.7	Reactor Vessel Internals	35	1,623	1,964	255	-	3,157	121	3,386	10,541	10,541	-	-	-	1,841	250	856	-	310,734	16,375	787
4a.1.1.8	Vessel & Internals GTCC Disposal	-	-	-	-	-	12,646	-	1,897	14,543	14,543	-	-	-	-	-	-	652	-	-	-
4a.1.1.9	Reactor Vessel	-	3,712	673	144	-	5,516	121	5,764	15,930	15,930	-	-	-	7,720	2,859	-	-	1,075,513	16,375	787
4a.1.1	Totals	163	9,372	6,430	1,493	3,868	35,660	241	16,829	74,057	74,057	-	-	23,353	34,596	3,110	856	652	4,615,558	67,964	1,574
Removal of Major Equipment																					
4a.1.2	Main Turbine/Generator	-	118	-	-	-	-	-	18	135	-	-	135	-	-	-	-	-	-	3,091	-
4a.1.3	Main Condensers	-	390	-	-	-	-	-	59	449	-	-	449	-	-	-	-	-	-	10,143	-
Disposal of Plant Systems																					
4a.1.4.1	100 Aux.Bldg Non-System Specific RCA	-	511	9	8	666	-	-	230	1,423	1,423	-	-	6,196	-	-	-	-	-	13,466	-
4a.1.4.2	100 Auxiliary Bldg Non-System Specific	-	76	1	1	72	10	-	33	193	193	-	-	670	22	-	-	-	1,968	2,030	-
4a.1.4.3	AB - Main Steam	-	192	-	-	-	-	-	29	221	-	-	221	-	-	-	-	-	-	5,833	-
4a.1.4.4	AB - Main Steam RCA	-	57	2	2	188	-	-	43	293	293	-	-	1,751	-	-	-	-	-	1,494	-
4a.1.4.5	AC - Main Turbine	-	190	-	-	-	-	-	28	218	-	-	218	-	-	-	-	-	-	5,641	-
4a.1.4.6	AD - Condensate	-	212	-	-	-	-	-	32	244	-	-	244	-	-	-	-	-	-	6,144	-
4a.1.4.7	AE - Feedwater	-	145	-	-	-	-	-	22	167	-	-	167	-	-	-	-	-	-	4,271	-
4a.1.4.8	AF - Feedwater Heater Extraction	-	177	-	-	-	-	-	27	203	-	-	203	-	-	-	-	-	-	5,352	-
4a.1.4.9	AK - Condensate Demineralizer	-	65	-	-	-	-	-	10	75	-	-	75	-	-	-	-	-	-	1,944	-
4a.1.4.10	AL - Auxiliary Feedwater	-	28	-	-	-	-	-	4	33	-	-	33	-	-	-	-	-	-	852	-
4a.1.4.11	AQ - Condensate & Feedwater Chem Addtn	-	16	-	-	-	-	-	2	18	-	-	18	-	-	-	-	-	-	468	-
4a.1.4.12	BM - Steam Generator Blowdown	-	74	1	1	101	-	-	34	212	212	-	-	940	-	-	-	-	-	1,965	-
4a.1.4.13	BM - Steam Generator Blowdown - RCA	-	261	5	4	359	-	-	120	749	749	-	-	3,337	-	-	-	-	-	6,846	-
4a.1.4.14	BN - Borated Refueling Water Storage	-	229	7	6	546	-	-	141	929	929	-	-	5,080	-	-	-	-	-	6,044	-
4a.1.4.15	CA - Steam Seal	-	15	-	-	-	-	-	2	17	-	-	17	-	-	-	-	-	-	455	-
4a.1.4.16	CB - Main Turbine Lube Oil	-	44	-	-	-	-	-	7	50	-	-	50	-	-	-	-	-	-	1,207	-
4a.1.4.17	CC - Generator Hydrogen Seal & CO2	-	7	-	-	-	-	-	1	8	-	-	8	-	-	-	-	-	-	198	-
4a.1.4.18	CD - Generator Seal Oil	-	10	-	-	-	-	-	1	11	-	-	11	-	-	-	-	-	-	287	-
4a.1.4.19	CE - Stator Cooling Water	-	9	-	-	-	-	-	1	10	-	-	10	-	-	-	-	-	-	241	-
4a.1.4.20	CF - Lube Oil Storage Xfer & Prfication	-	27	-	-	-	-	-	4	32	-	-	32	-	-	-	-	-	-	812	-
4a.1.4.21	CG - Condenser Air Removal	-	22	-	-	-	-	-	3	26	-	-	26	-	-	-	-	-	-	657	-
4a.1.4.22	CH - Main Turbine Control Oil	-	45	-	-	-	-	-	7	51	-	-	51	-	-	-	-	-	-	1,219	-
4a.1.4.23	DA - Circulating Water	-	249	-	-	-	-	-	37	287	-	-	287	-	-	-	-	-	-	7,502	-
4a.1.4.24	DB - Cooling Tower Makeup & Blowdown	-	42	-	-	-	-	-	6	49	-	-	49	-	-	-	-	-	-	1,260	-

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2002 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet	Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
4a.1.4.25	DD - Cooling Water Chemical Control Sys	-	37	-	-	-	-	-	6	42	-	-	42	-	-	-	-	-	-	1,073	-
4a.1.4.26	DD - Cooling Wtr Chem Control RCA	-	195	4	4	310	-	-	96	610	610	-	-	2,888	-	-	-	-	-	4,864	-
Disposal of Plant Systems (continued)																					
4a.1.4.27	EJ - Residual Heat Removal	-	249	16	8	391	373	-	217	1,254	1,254	-	-	3,639	825	-	-	-	73,823	6,666	-
4a.1.4.28	EM - High Pressure Coolant Injection	-	192	2	2	193	-	-	78	468	468	-	-	1,798	-	-	-	-	-	5,080	-
4a.1.4.29	EN - Containment Spray	-	152	3	3	264	-	-	78	501	501	-	-	2,457	-	-	-	-	-	4,003	-
4a.1.4.30	EP - Accumulator Safety Injection	-	109	2	2	174	-	-	54	340	340	-	-	1,615	-	-	-	-	-	2,844	-
4a.1.4.31	FA - Auxiliary Steam Generator	-	17	-	-	-	-	-	3	19	-	-	19	-	-	-	-	-	-	521	-
4a.1.4.32	FB - Auxiliary Steam	-	69	-	-	-	-	-	10	80	-	-	80	-	-	-	-	-	-	2,106	-
4a.1.4.33	FB - Auxiliary Steam RCA	-	58	1	1	71	-	-	25	156	156	-	-	663	-	-	-	-	-	1,491	-
4a.1.4.34	FC - Auxiliary Turbines	-	45	-	-	-	-	-	7	52	-	-	52	-	-	-	-	-	-	1,320	-
4a.1.4.35	FE - Auxiliary Steam Chemical Addition	-	4	-	-	-	-	-	1	4	-	-	4	-	-	-	-	-	-	105	-
4a.1.4.36	GE - Turbine Building HVAC	-	122	-	-	-	-	-	18	140	-	-	140	-	-	-	-	-	-	3,792	-
4a.1.4.37	GS - Containment Hydrogen Control	-	49	1	1	70	-	-	23	144	144	-	-	651	-	-	-	-	-	1,302	-
4a.1.4.38	HE - Boron Recycle	-	311	13	6	302	254	-	189	1,074	1,074	-	-	2,810	583	-	-	-	50,229	8,142	-
4a.1.4.39	HF - Secondary Liquid Waste	-	627	27	13	736	508	-	399	2,309	2,309	-	-	6,848	1,173	-	-	-	100,529	16,557	-
4a.1.4.40	JA - Auxiliary Oil & Transfer	-	23	-	-	-	-	-	3	26	-	-	26	-	-	-	-	-	-	687	-
4a.1.4.41	KS - Bulk Chemical Storage	-	68	7	6	563	-	-	103	747	747	-	-	5,238	-	-	-	-	-	1,805	-
4a.1.4.42	LE - Oily Waste	-	129	-	-	-	-	-	19	148	-	-	148	-	-	-	-	-	-	3,865	-
4a.1.4.43	LE - Oily Waste RCA	-	165	3	2	197	-	-	71	439	439	-	-	1,833	-	-	-	-	-	4,179	-
4a.1.4.44	Turbine Bldg Non-System Specific	-	543	-	-	-	-	-	81	624	-	-	624	-	-	-	-	-	-	15,405	-
4a.1.4	Totals	-	5,868	104	69	5,204	1,144	-	2,306	14,697	11,840	-	2,857	48,414	2,604	-	-	-	226,549	161,996	-
4a.1.5	Scaffolding in support of decommissioning	-	912	15	2	119	22	-	253	1,323	1,323	-	-	1,110	77	-	-	-	6,886	27,902	-
4a.1	Subtotal Period 4a Activity Costs	163	16,660	6,550	1,565	9,192	36,826	241	19,465	90,661	87,220	-	3,441	72,876	37,276	3,110	856	652	4,848,992	271,097	1,574
Period 4a Additional Costs																					
4a.2.1	Curie Surcharge (Excluding RPV)	-	-	-	-	-	29	-	7	36	36	-	-	-	-	-	-	-	-	-	-
4a.2	Subtotal Period 4a Additional Costs	-	-	-	-	-	29	-	7	36	36	-	-	-	-	-	-	-	-	-	-
Period 4a Collateral Costs																					
4a.3.1	Process liquid waste	4	-	3	10	-	46	-	15	79	79	-	-	-	-	73	-	-	9,185	14	-
4a.3.2	Small tool allowance	-	151	-	-	-	-	-	23	174	156	-	17	-	-	-	-	-	-	-	-
4a.3	Subtotal Period 4a Collateral Costs	4	151	3	10	-	46	-	38	253	236	-	17	-	-	73	-	-	9,185	14	-
Period 4a Period-Dependent Costs																					
4a.4.1	Decon supplies	39	-	-	-	-	-	-	10	48	48	-	-	-	-	-	-	-	-	-	-
4a.4.2	Insurance	-	-	-	-	-	-	424	42	466	466	-	-	-	-	-	-	-	-	-	-
4a.4.3	Property taxes	-	-	-	-	-	-	288	29	316	285	-	32	-	-	-	-	-	-	-	-
4a.4.4	Health physics supplies	-	1,009	-	-	-	-	-	252	1,261	1,261	-	-	-	-	-	-	-	-	-	-
4a.4.5	Heavy equipment rental	-	1,674	-	-	-	-	-	251	1,926	1,926	-	-	-	-	-	-	-	-	-	-
4a.4.6	Disposal of DAW generated	-	-	60	12	-	266	-	74	413	413	-	-	-	3,846	-	-	-	77,073	944	-
4a.4.7	Plant energy budget	-	-	-	-	-	-	850	128	978	978	-	-	-	-	-	-	-	-	-	-
4a.4.8	NRC Fees	-	-	-	-	-	-	403	40	443	443	-	-	-	-	-	-	-	-	-	-
4a.4.9	Radwaste Processing Equipment/Services	-	-	-	-	-	-	188	28	216	216	-	-	-	-	-	-	-	-	-	-
4a.4.10	Security Staff Cost	-	-	-	-	-	-	1,648	247	1,895	1,895	-	-	-	-	-	-	-	-	-	65,486
4a.4.11	DOC Staff Cost	-	-	-	-	-	-	11,317	1,698	13,015	13,015	-	-	-	-	-	-	-	-	-	170,263
4a.4.12	Utility Staff Cost	-	-	-	-	-	-	12,370	1,855	14,225	14,225	-	-	-	-	-	-	-	-	-	234,111
4a.4	Subtotal Period 4a Period-Dependent Costs	39	2,683	60	12	-	266	27,488	4,655	35,203	35,171	-	32	-	3,846	-	-	-	77,073	944	469,860
4a.0	TOTAL PERIOD 4a COST	205	19,494	6,613	1,587	9,192	37,167	27,729	24,165	126,153	122,663	-	3,490	72,876	41,122	3,183	856	652	4,935,250	272,055	471,434
PERIOD 4b - Site Decontamination																					
Period 4b Direct Decommissioning Activities																					
4b.1.1	Remove spent fuel racks	549	63	178	13	724	209	-	471	2,208	2,208	-	-	6,737	740	-	-	-	66,393	1,925	-
Disposal of Plant Systems																					
4b.1.2.1	200 Reactor Bldg Non-System Specific	-	60	1	1	44	6	-	23	134	134	-	-	408	13	-	-	-	1,198	1,569	-
4b.1.2.2	200 Reactor Bldg Non-System Specific RCA	-	404	5	5	416	-	-	165	995	995	-	-	3,872	-	-	-	-	-	10,422	-
4b.1.2.3	300 Control Bldg Non-System Specific	-	130	2	2	187	-	-	61	383	383	-	-	1,737	-	-	-	-	-	3,412	-
4b.1.2.4	300 Control Bldg Non-System Specific Cln	-	1,071	-	-	-	-	-	161	1,232	-	-	1,232	-	-	-	-	-	-	29,076	-
4b.1.2.5	600 Fuel Bldg Non-Specific Systems RCA	-	224	4	3	279	-	-	99	610	610	-	-	2,599	-	-	-	-	-	5,858	-
4b.1.2.6	600 Fuel Bldg Non-System Specific	-	32	0	0	28	4	-	13	78	78	-	-	261	9	-	-	-	768	850	-
4b.1.2.7	700 Radwaste Bldg Non-Sys Specific RCA	-	834	14	13	1,107	-	-	378	2,346	2,346	-	-	10,302	-	-	-	-	-	21,912	-
4b.1.2.8	700 Radwaste Bldg Non-System Specific	-	123	2	1	116	16	-	52	310	310	-	-	1,079	35	-	-	-	3,172	3,252	-

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4b.1.2.9	AN - Demineralized Wtr Storage & Xfer	-	108	-	-	-	-	-	16	124	-	-	124	-	-	-	-	-	-	3,283	-
4b.1.2.10	AN - Demineralized Wtr Strg & Xfer RCA	-	28	0	0	27	-	-	11	67	67	-	-	255	-	-	-	-	-	711	-
4b.1.2.11	AP - Condensate Storage & Transfer	-	65	-	-	-	-	-	10	75	-	-	75	-	-	-	-	-	-	1,794	-
4b.1.2.12	BB - Reactor Coolant System	-	202	14	6	226	361	-	177	986	986	-	-	2,101	903	-	-	-	71,577	5,501	-
4b.1.2.13	BG - Chemical & Volume Control	488	576	36	15	715	827	-	708	3,365	3,365	-	-	6,653	1,842	-	-	-	163,728	23,108	-
4b.1.2.14	BL - Reactor Makeup Water	-	192	8	4	221	134	-	116	674	674	-	-	2,054	315	-	-	-	26,460	5,043	-
4b.1.2.15	DE - Intake & Water Treatment	-	434	-	-	-	-	-	65	499	-	-	499	-	-	-	-	-	-	12,917	-
4b.1.2.16	DE - Intake & Water Treatment RCA	-	186	14	12	1,041	-	-	206	1,459	1,459	-	-	9,684	-	-	-	-	-	4,986	-
4b.1.2.17	EA - Service Water	-	104	-	-	-	-	-	16	120	-	-	120	-	-	-	-	-	-	3,145	-
4b.1.2.18	EA - Service Water RCA	-	32	1	1	109	-	-	25	169	169	-	-	1,014	-	-	-	-	-	828	-
4b.1.2.19	EB - Closed Cooling Water	-	41	-	-	-	-	-	6	48	-	-	48	-	-	-	-	-	-	1,267	-
4b.1.2.20	EC - Fuel Pool Cooling & Cleanup	-	248	5	4	360	-	-	117	733	733	-	-	3,346	-	-	-	-	-	6,515	-
4b.1.2.21	EF - Essential Service Water	-	241	-	-	-	-	-	36	277	-	-	277	-	-	-	-	-	-	7,244	-
4b.1.2.22	EF - Essential Service Water RCA	-	144	6	5	465	-	-	107	727	727	-	-	4,326	-	-	-	-	-	3,799	-
4b.1.2.23	EG - Component Cooling Water RCA	-	175	-	-	-	-	-	26	201	-	-	201	-	-	-	-	-	-	5,335	-
4b.1.2.24	GA - Plant Heating	-	62	-	-	-	-	-	9	71	-	-	71	-	-	-	-	-	-	1,912	-
4b.1.2.25	GA - Plant Heating RCA	-	66	1	1	56	-	-	25	148	148	-	-	518	-	-	-	-	-	1,697	-
4b.1.2.26	GA- Plant Heating Fuel Building	-	13	0	0	9	-	-	5	28	28	-	-	87	-	-	-	-	-	347	-
4b.1.2.27	GB - Central Chilled Water	-	58	-	-	-	-	-	9	67	-	-	67	-	-	-	-	-	-	1,803	-
4b.1.2.28	GB - Central Chilled Water RCA	-	18	0	0	16	-	-	7	42	42	-	-	152	-	-	-	-	-	463	-
4b.1.2.29	GD - Essential Serv Wtr Pumphouse HVAC	-	13	-	-	-	-	-	2	15	-	-	15	-	-	-	-	-	-	414	-
4b.1.2.30	GF - Miscellaneous Building HVAC	-	129	2	2	178	-	-	60	371	371	-	-	1,652	-	-	-	-	-	2,884	-
4b.1.2.31	GG - Fuel Building HVAC	-	249	4	4	344	-	-	115	717	717	-	-	3,204	-	-	-	-	-	5,809	-
4b.1.2.32	GH - Radwaste Building HVAC	-	178	3	3	224	-	-	79	486	486	-	-	2,080	-	-	-	-	-	4,190	-
4b.1.2.33	GK - Control Building HVAC	-	122	-	-	-	-	-	18	141	-	-	141	-	-	-	-	-	-	3,900	-
4b.1.2.34	GL - Auxiliary Building HVAC	-	453	6	5	470	-	-	185	1,119	1,119	-	-	4,370	-	-	-	-	-	10,552	-
4b.1.2.35	GM - Diesel Generator Building HVAC	-	21	-	-	-	-	-	3	25	-	-	25	-	-	-	-	-	-	692	-
4b.1.2.36	GN - Containment Cooling	-	444	9	8	722	-	-	221	1,404	1,404	-	-	6,712	-	-	-	-	-	10,629	-
4b.1.2.37	GP - Containment Intgratd Leak Rate Test	-	28	1	1	51	-	-	15	95	95	-	-	471	-	-	-	-	-	737	-
4b.1.2.38	GR - Containment Atmospheric Control	-	13	1	1	100	-	-	19	134	134	-	-	928	-	-	-	-	-	349	-
4b.1.2.39	GT - Containment Purge HVAC	-	107	2	2	191	-	-	56	359	359	-	-	1,775	-	-	-	-	-	2,569	-
4b.1.2.40	HA - Gaseous Radwaste	-	225	4	4	323	-	-	106	661	661	-	-	3,004	-	-	-	-	-	5,766	-
4b.1.2.41	HB - Liquid Radwaste	525	555	26	11	643	463	-	618	2,840	2,840	-	-	5,979	1,077	-	-	-	91,712	26,595	-
4b.1.2.42	HC - Solid Radwaste	-	296	17	7	348	387	-	226	1,281	1,281	-	-	3,238	864	-	-	-	76,646	7,753	-
4b.1.2.43	HD - Decontamination	-	68	3	1	86	55	-	44	258	258	-	-	799	125	-	-	-	10,842	1,766	-
4b.1.2.44	JE - Emergency Fuel Oil	-	45	-	-	-	-	-	7	52	-	-	52	-	-	-	-	-	-	1,260	-
4b.1.2.45	KA - Compressed Air	-	135	-	-	-	-	-	20	155	-	-	155	-	-	-	-	-	-	4,187	-
4b.1.2.46	KA - Compressed Air RCA	-	89	1	1	70	-	-	33	193	193	-	-	651	-	-	-	-	-	2,241	-
4b.1.2.47	KB - Breathing Air	-	17	-	-	-	-	-	2	19	-	-	19	-	-	-	-	-	-	516	-
4b.1.2.48	KB - Breathing Air RCA	-	13	0	0	6	-	-	4	24	24	-	-	57	-	-	-	-	-	376	-
4b.1.2.49	KC - Fire Protection	-	270	-	-	-	-	-	41	311	-	-	311	-	-	-	-	-	-	8,376	-
4b.1.2.50	KC - Fire Protection RCA	-	284	5	4	385	-	-	130	808	808	-	-	3,583	-	-	-	-	-	6,950	-
4b.1.2.51	KC- Fire Protection Fuel Building	-	84	1	1	108	-	-	38	233	233	-	-	1,007	-	-	-	-	-	2,083	-
4b.1.2.52	KD - Domestic Water	-	125	-	-	-	-	-	19	144	-	-	144	-	-	-	-	-	-	3,837	-
4b.1.2.53	KD - Domestic Water RCA	-	18	0	0	22	-	-	8	48	48	-	-	201	-	-	-	-	-	448	-
4b.1.2.54	KE - Fuel Handling & Storage Rctor vssl	-	13	1	1	77	-	-	15	107	107	-	-	716	-	-	-	-	-	332	-
4b.1.2.55	KH - Service Gas (CO2 N2 H2 & O2)	-	40	-	-	-	-	-	6	46	-	-	46	-	-	-	-	-	-	1,226	-
4b.1.2.56	KH - Service Gas (CO2 N2 H2 & O2) RCA	-	178	3	2	212	-	-	77	472	472	-	-	1,976	-	-	-	-	-	4,377	-
Disposal of Plant Systems (continued)																					
4b.1.2.57	KJ - Standby Diesel Engine	-	239	-	-	-	-	-	36	275	-	-	275	-	-	-	-	-	-	6,749	-
4b.1.2.58	LA - Sanitary Drains	-	32	-	-	-	-	-	5	37	-	-	37	-	-	-	-	-	-	972	-
4b.1.2.59	LA - Sanitary Drains RCA	-	76	1	1	111	-	-	36	226	226	-	-	1,034	-	-	-	-	-	1,810	-
4b.1.2.60	LB - Roof Drains	-	42	-	-	-	-	-	6	49	-	-	49	-	-	-	-	-	-	1,276	-
4b.1.2.61	LB - Roof Drains RCA	-	102	2	2	187	-	-	54	347	347	-	-	1,737	-	-	-	-	-	2,627	-
4b.1.2.62	LD - Chemical & Detergent Waste	44	71	1	1	70	-	-	50	237	237	-	-	647	-	-	-	-	-	2,860	-
4b.1.2.63	LF - Floor & Equipment Drains	-	915	40	17	581	1,160	-	612	3,325	3,325	-	-	5,409	2,567	-	-	-	229,676	23,956	-
4b.1.2.64	RM - Process Sampling & Analysis	-	91	1	1	86	-	-	36	215	215	-	-	804	-	-	-	-	-	2,404	-
4b.1.2.65	SJ - Nuclear Sampling	-	51	1	1	59	-	-	22	133	133	-	-	550	-	-	-	-	-	1,351	-
4b.1.2.66	UB - Servces Stores Site Security Bldg	-	122	-	-	-	-	-	18	140	-	-	140	-	-	-	-	-	-	3,571	-
4b.1.2.67	Yard Non-System Specific	-	22	-	-	-	-	-	3	25	-	-	25	-	-	-	-	-	-	603	-
4b.1.2	Totals	1,057	11,847	251	156	11,076	3,413	-	5,693	33,493	29,347	-	4,145	103,035	7,750	-	-	-	675,779	337,042	-
4b.1.3	Scaffolding in support of decommissioning	-	1,368	23	3	179	33	-	380	1,985	1,985	-	-	1,665	115	-	-	-	10,328	41,853	-
Decontamination of Site Buildings																					
4b.1.4.1	Reactor	834	636	96	53	520	1,086	-	943	4,168	4,168	-	-	4,837	7,077	-	-	-	665,147	37,563	-
4b.1.4.2	Auxiliary	423	159	24	14	180	43	-	294	1,138	1,138	-	-	1,672	1,704	-	-	-	166,710	15,114	-
4b.1.4.3	Communication Corridor - Contaminated	9	2	0	0	1	1	-	6	21	21	-	-	13	36	-	-	-	3,622	306	-

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2002 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
4b.1.4.4	Fuel Building	544	547	10	6	236	28	-	453	1,824	1,824	-	-	2,197	494	-	-	-	48,132	27,267	-
4b.1.4.5	Hot Machine Shop	12	3	1	0	-	1	-	7	23	23	-	-	-	44	-	-	-	4,446	369	-
4b.1.4.6	RAM Storage Building	29	6	1	1	2	2	-	17	58	58	-	-	15	93	-	-	-	9,214	922	-
4b.1.4.7	Radioactive and Personnel Tunnel	4	3	0	0	-	0	-	3	11	11	-	-	-	25	-	-	-	2,532	168	-
4b.1.4.8	Radwaste	226	73	12	7	74	21	-	150	563	563	-	-	686	894	-	-	-	88,167	7,754	-
4b.1.4.9	Radwaste Drum Storage	25	7	1	1	6	2	-	16	59	59	-	-	54	99	-	-	-	9,866	846	-
4b.1.4	Totals	2,107	1,438	146	83	1,018	1,183	-	1,888	7,864	7,864	-	-	9,474	10,468	-	-	-	997,837	90,308	-
4b.1	Subtotal Period 4b Activity Costs	3,713	14,716	598	255	12,998	4,838	-	8,432	45,549	41,404	-	4,145	120,910	19,073	-	-	-	1,750,338	471,128	-
Period 4b Collateral Costs																					
4b.3.1	Process liquid waste	18	-	118	180	-	1,404	-	399	2,118	2,118	-	-	-	-	1,728	-	-	278,031	96	-
4b.3.2	Small tool allowance	-	272	-	-	-	-	-	41	313	313	-	-	-	-	-	-	-	-	-	-
4b.3.3	Decommissioning Equipment Disposition	-	-	75	10	581	106	-	122	894	894	-	-	5,400	373	-	-	-	33,507	739	-
4b.3	Subtotal Period 4b Collateral Costs	18	272	193	190	581	1,510	-	562	3,325	3,325	-	-	5,400	373	1,728	-	-	311,537	835	-
Period 4b Period-Dependent Costs																					
4b.4.1	Decon supplies	806	-	-	-	-	-	-	201	1,007	1,007	-	-	-	-	-	-	-	-	-	-
4b.4.2	Insurance	-	-	-	-	-	-	394	39	434	434	-	-	-	-	-	-	-	-	-	-
4b.4.3	Property taxes	-	-	-	-	-	-	360	36	396	396	-	-	-	-	-	-	-	-	-	-
4b.4.4	Health physics supplies	-	1,647	-	-	-	-	-	412	2,059	2,059	-	-	-	-	-	-	-	-	-	-
4b.4.5	Heavy equipment rental	-	2,184	-	-	-	-	-	328	2,512	2,512	-	-	-	-	-	-	-	-	-	-
4b.4.6	Disposal of DAW generated	-	-	95	20	-	424	-	119	658	658	-	-	-	6,131	-	-	-	122,868	1,505	-
4b.4.7	Plant energy budget	-	-	-	-	-	-	1,020	153	1,173	1,173	-	-	-	-	-	-	-	-	-	-
4b.4.8	NRC Fees	-	-	-	-	-	-	473	47	520	520	-	-	-	-	-	-	-	-	-	-
4b.4.9	Radwaste Processing Equipment/Services	-	-	-	-	-	-	471	71	542	542	-	-	-	-	-	-	-	-	-	-
4b.4.10	Security Staff Cost	-	-	-	-	-	-	2,062	309	2,371	2,371	-	-	-	-	-	-	-	-	-	81,943
4b.4.11	DOC Staff Cost	-	-	-	-	-	-	13,762	2,064	15,827	15,827	-	-	-	-	-	-	-	-	-	207,589
4b.4.12	Utility Staff Cost	-	-	-	-	-	-	15,042	2,256	17,298	17,298	-	-	-	-	-	-	-	-	-	282,020
4b.4	Subtotal Period 4b Period-Dependent Costs	806	3,832	95	20	-	424	33,585	6,036	44,797	44,797	-	-	-	6,131	-	-	-	122,868	1,505	571,551
4b.0	TOTAL PERIOD 4b COST	4,536	18,819	886	465	13,578	6,772	33,585	15,030	93,671	89,526	-	4,145	126,310	25,578	1,728	-	-	2,184,743	473,469	571,551
PERIOD 4e - License Termination																					
Period 4e Direct Decommissioning Activities																					
4e.1.1	ORISE confirmatory survey	-	-	-	-	-	-	120	36	156	156	-	-	-	-	-	-	-	-	-	-
4e.1.2	Terminate license									a											
4e.1	Subtotal Period 4e Activity Costs	-	-	-	-	-	-	120	36	156	156	-	-	-	-	-	-	-	-	-	-
Period 4e Additional Costs																					
4e.2.1	Final Site Survey	-	-	-	-	-	-	5,999	1,800	7,799	7,799	-	-	-	-	-	-	-	-	146,136	-
4e.2	Subtotal Period 4e Additional Costs	-	-	-	-	-	-	5,999	1,800	7,799	7,799	-	-	-	-	-	-	-	-	146,136	-
Period 4e Collateral Costs																					
4e.3.1	DOC staff relocation expenses	-	-	-	-	-	-	753	113	866	866	-	-	-	-	-	-	-	-	-	-
4e.3	Subtotal Period 4e Collateral Costs	-	-	-	-	-	-	753	113	866	866	-	-	-	-	-	-	-	-	-	-
Period 4e Period-Dependent Costs																					
4e.4.1	Insurance	-	-	-	-	-	-	229	23	252	252	-	-	-	-	-	-	-	-	-	-
4e.4.2	Property taxes	-	-	-	-	-	-	209	21	230	230	-	-	-	-	-	-	-	-	-	-
4e.4.3	Health physics supplies	-	586	-	-	-	-	-	146	732	732	-	-	-	-	-	-	-	-	-	-
4e.4.4	Disposal of DAW generated	-	-	5	1	-	21	-	6	33	33	-	-	-	308	-	-	-	6,172	76	-
4e.4.5	Plant energy budget	-	-	-	-	-	-	429	64	493	493	-	-	-	-	-	-	-	-	-	-
4e.4.6	NRC Fees	-	-	-	-	-	-	327	33	360	360	-	-	-	-	-	-	-	-	-	-
4e.4.7	Security Staff Cost	-	-	-	-	-	-	360	54	414	414	-	-	-	-	-	-	-	-	-	14,297
4e.4.8	DOC Staff Cost	-	-	-	-	-	-	5,586	838	6,423	6,423	-	-	-	-	-	-	-	-	-	81,017
4e.4.9	Utility Staff Cost	-	-	-	-	-	-	4,141	621	4,763	4,763	-	-	-	-	-	-	-	-	-	68,706
4e.4	Subtotal Period 4e Period-Dependent Costs	-	586	5	1	-	21	11,281	1,806	13,700	13,700	-	-	-	308	-	-	-	6,172	76	164,020
4e.0	TOTAL PERIOD 4e COST	-	586	5	1	-	21	18,154	3,755	22,521	22,521	-	-	-	308	-	-	-	6,172	146,212	164,020
PERIOD 4 TOTALS		4,742	38,899	7,504	2,053	22,770	43,960	79,467	42,949	242,345	234,710	-	7,635	199,186	67,008	4,911	856	652	7,126,165	891,735	1,207,005
PERIOD 5b - Site Restoration																					

Table D
Callaway Plant
SAFSTOR Decommissioning Cost Estimate
(Thousands of 2002 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
Period 5b Direct Decommissioning Activities																					
Demolition of Remaining Site Buildings																					
5b.1.1.1	Reactor	-	4,414	-	-	-	-	-	662	5,076	-	-	5,076	-	-	-	-	-	-	73,822	-
5b.1.1.2	Auxiliary	-	3,157	-	-	-	-	-	474	3,630	-	-	3,630	-	-	-	-	-	-	59,349	-
5b.1.1.3	Auxiliary Boiler	-	27	-	-	-	-	-	4	31	-	-	31	-	-	-	-	-	-	587	-
5b.1.1.4	Circulating & Service Water Pumphouse	-	202	-	-	-	-	-	30	233	-	-	233	-	-	-	-	-	-	4,138	-
5b.1.1.5	Communication Corridor - Clean	-	1,025	-	-	-	-	-	154	1,179	-	-	1,179	-	-	-	-	-	-	20,542	-
5b.1.1.6	Communication Corridor - Contaminated	-	39	-	-	-	-	-	6	45	-	-	45	-	-	-	-	-	-	666	-
5b.1.1.7	Cooling Tower	-	1,017	-	-	-	-	-	153	1,170	-	-	1,170	-	-	-	-	-	-	17,975	-
5b.1.1.8	Diesel Generator	-	364	-	-	-	-	-	55	419	-	-	419	-	-	-	-	-	-	6,119	-
5b.1.1.9	Essential Service Water Pumphouse	-	123	-	-	-	-	-	18	142	-	-	142	-	-	-	-	-	-	2,766	-
5b.1.1.10	Fire Water Pumphouse	-	22	-	-	-	-	-	3	26	-	-	26	-	-	-	-	-	-	375	-
5b.1.1.11	Fuel Building	-	1,679	-	-	-	-	-	252	1,931	-	-	1,931	-	-	-	-	-	-	27,061	-
5b.1.1.12	Hot Machine Shop	-	21	-	-	-	-	-	3	25	-	-	25	-	-	-	-	-	-	464	-
5b.1.1.13	Intake	-	262	-	-	-	-	-	39	301	-	-	301	-	-	-	-	-	-	4,166	-
5b.1.1.14	Misc. Structures	-	1,785	-	-	-	-	-	268	2,052	-	-	2,052	-	-	-	-	-	-	28,096	-
5b.1.1.15	Miscellaneous Site Foundations	-	318	-	-	-	-	-	48	366	-	-	366	-	-	-	-	-	-	5,368	-
5b.1.1.16	Outage Maintenance	-	149	-	-	-	-	-	22	172	-	-	172	-	-	-	-	-	-	3,222	-
5b.1.1.17	RAM Storage Building	-	37	-	-	-	-	-	6	42	-	-	42	-	-	-	-	-	-	920	-
5b.1.1.18	Radioactive and Personnel Tunnel	-	26	-	-	-	-	-	4	30	-	-	30	-	-	-	-	-	-	652	-
5b.1.1.19	Radwaste	-	1,337	-	-	-	-	-	201	1,538	-	-	1,538	-	-	-	-	-	-	24,007	-
5b.1.1.20	Radwaste Drum Storage	-	216	-	-	-	-	-	32	249	-	-	249	-	-	-	-	-	-	3,857	-
Demolition of Remaining Site Buildings (continued)																					
5b.1.1.21	Service	-	340	-	-	-	-	-	51	391	-	-	391	-	-	-	-	-	-	5,611	-
5b.1.1.22	Sludge Pump Station & Lagoon	-	17	-	-	-	-	-	3	20	-	-	20	-	-	-	-	-	-	316	-
5b.1.1.23	Turbine Building	-	3,796	-	-	-	-	-	569	4,365	-	-	4,365	-	-	-	-	-	-	87,807	-
5b.1.1.24	Turbine Pedestal	-	752	-	-	-	-	-	113	865	-	-	865	-	-	-	-	-	-	10,928	-
5b.1.1.25	U.H.S. Cooling Tower	-	451	-	-	-	-	-	68	518	-	-	518	-	-	-	-	-	-	6,615	-
5b.1.1.26	Water Treatment Plant	-	0	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	-	8	-
5b.1.1	Totals	-	21,577	-	-	-	-	-	3,237	24,813	-	-	24,813	-	-	-	-	-	-	395,436	-
Site Closeout Activities																					
5b.1.2	BackFill Site	-	3,165	-	-	-	-	-	475	3,640	-	-	3,640	-	-	-	-	-	-	17,176	-
5b.1.3	Grade & landscape site	-	1,478	-	-	-	-	-	222	1,699	-	-	1,699	-	-	-	-	-	-	5,839	-
5b.1.4	Final report to NRC	-	-	-	-	-	-	114	17	132	132	-	-	-	-	-	-	-	-	-	1,560
5b.1	Subtotal Period 5b Activity Costs	-	26,220	-	-	-	-	114	3,950	30,284	132	-	30,153	-	-	-	-	-	-	418,450	1,560
Period 5b Additional Costs																					
5b.2.1	Concrete Crushing	-	555	-	-	-	-	131	103	789	789	-	-	-	-	-	-	-	-	4,145	-
5b.2	Subtotal Period 5b Additional Costs	-	555	-	-	-	-	131	103	789	789	-	-	-	-	-	-	-	-	4,145	-
Period 5b Collateral Costs																					
5b.3.1	Small tool allowance	-	237	-	-	-	-	-	36	272	-	-	272	-	-	-	-	-	-	-	-
5b.3	Subtotal Period 5b Collateral Costs	-	237	-	-	-	-	-	36	272	-	-	272	-	-	-	-	-	-	-	-
Period 5b Period-Dependent Costs																					
5b.4.1	Insurance	-	-	-	-	-	-	451	45	496	-	-	496	-	-	-	-	-	-	-	-
5b.4.2	Property taxes	-	-	-	-	-	-	412	41	453	-	-	453	-	-	-	-	-	-	-	-
5b.4.3	Heavy equipment rental	-	3,384	-	-	-	-	-	508	3,891	-	-	3,891	-	-	-	-	-	-	-	-
5b.4.4	Plant energy budget	-	-	-	-	-	-	50	7	57	-	-	57	-	-	-	-	-	-	-	-
5b.4.5	Security Staff Cost	-	-	-	-	-	-	708	106	814	-	-	814	-	-	-	-	-	-	-	28,131
5b.4.6	DOC Staff Cost	-	-	-	-	-	-	8,567	1,285	9,852	-	-	9,852	-	-	-	-	-	-	-	121,903
5b.4.7	Utility Staff Cost	-	-	-	-	-	-	3,052	458	3,510	-	-	3,510	-	-	-	-	-	-	-	48,449
5b.4	Subtotal Period 5b Period-Dependent Costs	-	3,384	-	-	-	-	13,240	2,450	19,074	-	-	19,074	-	-	-	-	-	-	-	198,483
5b.0	TOTAL PERIOD 5b COST	-	30,395	-	-	-	-	13,485	6,539	50,419	920	-	49,499	-	-	-	-	-	-	422,595	200,043
PERIOD 5 TOTALS		-	30,395	-	-	-	-	13,485	6,539	50,419	920	-	49,499	-	-	-	-	-	-	422,595	200,043
TOTAL COST TO DECOMMISSION		9,215	75,239	8,057	2,538	22,770	47,302	371,030	92,567	628,719	546,052	24,604	58,063	199,186	96,040	7,595	856	652	8,576,939	1,395,450	5,124,364

TOTAL COST TO DECOMMISSION WITH 17.27% CONTINGENCY: $628,719 thousands of 2002 dollars

Table D
Callaway Plant
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(Thousands of 2002 Dollars)

Activity Index	Activity Description	Decon Cost	Removal Cost	Packaging Costs	Transport Costs	Off-Site Processing Costs	LLRW Disposal Costs	Other Costs	Total Contingency	Total Costs	NRC Lic. Term. Costs	Spent Fuel Management Costs	Site Restoration Costs	Processed Volume Cu. Feet	Burial Volumes				Burial Weight Lbs.	Craft Manhours	Utility and Contractor Manhours
															Class A Cu. Feet	Class B Cu. Feet	Class C Cu. Feet	GTCC Cu. Feet			
TOTAL NRC LICENSE TERMINATION COST IS 86.85% OR				**$546,052**	**thousands of 2002 dollars**																
SPENT FUEL MANAGEMENT COST IS 3.91% OR:				**$24,604**	**thousands of 2002 dollars**																
NON-NUCLEAR DEMOLITION COST IS 9.24% OR:				**$58,063**	**thousands of 2002 dollars**																
TOTAL PRIMARY SITE RADWASTE VOLUME BURIED:				**52,761**	**cubic feet**																
TOTAL SECONDARY SITE RADWASTE VOLUME BURIED:				**45,153**	**cubic feet**																
TOTAL TERTIARY SITE RADWASTE VOLUME BURIED:				**6,577**	**cubic feet**																
TOTAL GREATER THAN CLASS C RADWASTE VOLUME GENERATED:				**652**	**cubic feet**																
TOTAL SCRAP METAL REMOVED:				**76,118**	**tons**																
TOTAL CRAFT LABOR REQUIREMENTS:				**1,395,450**	**man-hours**																

End Notes:
n/a - indicates that this activity not charged as decommissioning expense.
a - indicates that this activity performed by decommissioning staff.
0 - indicates that this value is less than 0.5 but is non-zero.
a cell containing " - " indicates a zero value